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A. T. Colwell, President — David Beecroft, Treasurer

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About Authors

▪ MORRIS ASIMOW *graduated from the University of California in 1927, M.S. in 1932 and Ph.D. in 1934. Before securing his present job of manager, Central Metal Products Co., Los Angeles, Calif., he spent two years ('27-'28) as junior engineer, Southern California Edison Co., Ltd., three years as tool and die maker and designer; six years as instructor in metallurgical engineering at University of California; and four years as research metallurgist, Carnegie-Illinois Steel Corp.*

▪ *Many days of interviews with leading automobile engineers and materials experts in automobile centers, and weeks of careful study and analysis of the alternate-materials-in-defense situation, have been the immediate background for* T. A. BISSELL'S *(M '37) paper "Designing For Alternate Materials."* Mr. *Bissell, who has been technical editor of the SAE Journal since 1935, received his M.E. from Cornell in 1923. He had eight years of plant, production, and sales engineering experience before he began his editorial career on the staff of "Maintenance Engineering," a McGraw-Hill publication. Since then he has been doing technical editorial work. He is author of the article on automotive engineering covering the 1941 cars, published in the current edition of the American Year Book.*

▪ ALFRED L. BOEGEHOLD, *of the General Motors Research Laboratories, Dayton, Ohio, is a member of a special committee of the National Academy of Sciences asked by the OPM to investigate and report on possible substitutes for various metals vital to defense. He joined the G.M. Research Laboratories in 1920, and five years later became head of the department of metallurgy – a position he still holds. Mr. Boegehold's broad engineering experience includes work in munitions, a brass mill, army ordnance and cutlery manufacture. He was graduated from Cornell with an M.E. degree in 1915.*

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C. B. Whittelsey, Jr., *Business Manager*, 29 West 39th St., New York, N. Y.

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"Senator" Ed Ford, speaker of the evening; President A. T. Colwell, toastmaster; and Aircraft Vice-President George W. Lewis were at the center of the Speakers' Table for the dinner which opened the meeting on Sunday evening, June 1

Defense Impact on Industry Stressed at 1941 SAE Summer Meeting Sessions

BLUNTLY stated realities about the impact of defense on every department of every branch of the automotive industry emanated from military leaders, OPM authorities, and automotive engineers at practically every session of the SAE Summer Meeting held at White Sulphur Springs, West Va., June 1-6.

The largest attendance in recent years marked this momentous meeting of the technicians upon whom rests heavy responsibility for America's success in preparation for mechanized war. Significant information and ideas exploded day after day.

■ Eastern Oil Curtailment Necessary

"Some definite curtailment of East Coast petroleum consumption will be necessary this summer and fall," OPM petroleum unit expert Dr. Robert E. Wilson warned, after stressing the adequacy of America's petroleum supplies and explaining East Coast difficulties to be due entirely to transportation shortages. These shortages, he explained, come only in part from diversion of 50 tankers to British service. Dramatically he rehearsed the unsuccessful nine-months' fight to get permission for construction of two gasoline pipe lines in Southeastern States, which private capital was willing to construct if necessary rights-of-way could be secured. "It seems inconceivable to me," he said forcefully, "that one interstate carrier which employed the right of eminent domain to secure its own right-of-way should be permitted to use that right-of-way to block a competing interstate carrier. It is equally difficult to understand how the Georgia legislature could turn down the request of the President, plus the Secretaries of War, Navy, and Interior, urging that enabling legislation be passed to make possible the construction of these facilities which are so important under the emergency conditions which we are facing."

Other dramatic situations were revealed as the meeting went on.

■ Tank Progress Dramatic

Brig.-Gen. G. M. Barnes, Assistant Chief of Ordnance, revealed that improvements of over 1000% in the accuracy of fire of our U. S. Army tank weapons have been effected in recent years – and that production of light tanks has reached such a satisfactory point that "no shortages of light tanks can possibly occur under any emergency situation." Design changes in the medium tank based on lessons learned to date in Europe, he announced, have resulted in "a very superior vehicle" to be built in quantity – at the expense of a few months' delay which is now past. The new heavy tank will be ready for test early in July, he added.

■ German Engine Has Quality

High regard for the quality and design of the Mercedes-Benz aircraft engine was expressed by SAE aircraft experts in discussions based on analysis of such an engine taken from a Messerschmitt fighter plane shot down by the British. Technical features brought to light included auto-

Dr. Robert E. Wilson

matic mixture control, solid fuel injection and fluid supercharger drive. No useless effort in man-hours or finish has been expended in building this engine where there is not a direct return in increased reliability and performance, Raymond W. Young, Wright Aeronautical Corp., reported, but added that "the polishing of stressed parts is of the highest order." He concluded that "despite wishful thinking to the contrary, the performance of the DB-601-A with respect to sea level and altitude output, fuel consumption, and weight seems to be on a par with contemporary powerplants of the same general type."

■ New Ideas Stressed

Capt. J. E. Engler, Quartermaster Corps, told the truck engineers frankly that it is the policy of his testing division "to encourage development of or demand the supposedly impossible" because finished products must be secured which will stand the gaff of modern warfare.

With the passenger car playing a far more important role in defense-needed transportation than in any previous emergency period, leading passenger-car engineers were found attacking the problem of car economy from every conceivable angle and grasping for new ideas and possibilities in the utilization of materials to substitute for those needed in greatest volume for defense purposes. It is practical to streamline for fuel economy, James C. Zeder, Chrysler Corp., showed in casting much new light on an oft-labored topic, "IF – and only if – the power system is engineered to fit the body." H. T. Youngren, Olds Motor Works Division, General Motors Corp., stressed reduction of engine speed, lighter weight cars and the economical and general availability of higher octane fuels to permit higher compression ratios as "the real economy factors."

At other sessions, current Diesel problems were debated, results of recent fuels and lubricants researches and tests were revealed, design elements affecting truck safety were discussed, motor-truck load distribution was analyzed, plastic automobile bodies were visioned as a development of the near future, modern welding techniques as applied to steel crankcases were expounded, and scores of other topics were argued.

The opening day of the meeting was devoted to Council and comittee meetings and was topped off by a dinner in the evening at which serious subjects were taboo. SAE President Arch Colwell as toastmaster introduced one of America's leading humorists, "Senator" Ed Ford – and the "Senator" lived up to a glowing introduction by setting what must have been a new laugh-per-minute record.

A brief business session was held preceding the technical session on Monday evening.

Petroleum and the War – DR. R. E. WILSON, Office of Production Management, Petroleum Unit; and Pan American Petroleum and Transport Co.

THERE are no bottlenecks in the petroleum industry. In fact, the number of potential trouble spots are so few as to be insignificant. That was one of the striking statements made by Dr. R. E. Wilson. Of equal interest was the speaker's prophecy that, if and when England can achieve sufficient air superiority to permit long range and heavy daylight attacks on German synthetic plants and transportation facilities, she will be striking at such a vital spot that "actual invasion might never be necessary in order for England to win the war."

According to Dr. Wilson, petroleum production has sufficient reserves to carry defense demands for two years without disturbing new fields; petroleum refining has enough unused capacity that only moderate expansion will be necessary to meet requirements; lubricating oils are in an equally happy state; and only in the heavy fuel storage and gasoline transportation facilities on the East Coast is there cause for any concern. In the European theater of war, the author indicated, Germany has adequate gasoline supplies to keep its mechanized army going at its present pace indefinitely.

Referring to the shortage of transportation facilities on the East Coast brought about by diversion of 50 tankers to British service, Dr. Wilson stressed the combined attempts of the petroleum industry and the OPM since last August to get rights-of-way granted for two large pipe-line projects in the Southeastern states which the industry stood ready to build. The lines, he said frankly, have been blocked by railroad opposition and the failure of the Georgia legislature to enact the needed legislation. The situation should be cleared up soon, he indicated, by enactment by Congress of the Cole bill which will give rights-of-way to interstate carriers certified by the President as being in the interest of national defense.

In the production field, Dr. Wilson said, state conservation of supplies has been so intelligently handled that today we have vast underground reservoirs that can be tapped whenever the need arises. Of equal significance, he pointed out, has been the encouragement of wildcatting which has opened up many new sources of supply, also, the speaker praised the sound defense policy of keeping oil prices in line. Recent detailed state-by-state estimates referred to by Dr. Wilson indicate that, without heavy drilling programs, production could be increased by 30% and maintained at that figure for at least two years without any major new discoveries. However, Dr. Wilson warned that the industry must not relax its normal activity toward making new discoveries.

"In refining," Dr. Wilson said, "the possibilities of immediate expansion of output to meet sharp increase of demand is not quite as great as in production; but nevertheless, our civilian demand is so large that it still dwarfs every possible military demand, even though a few special products require special attention." He went on to point out that our unused refinery capacity of around 1,000,000 bbl daily is greater and more efficient than was our entire capacity in 1917. Nevertheless, refineries should keep expanding fast enough, he urged, to keep pace with the growth of peacetime consumption and keep customary reserves of about 20% of shutdown capacity available for emergency wartime needs – for which purpose it is more than adequate.

According to Dr. Wilson, America has plant capacity to turn out enough synthetic 100 octane aviation gasoline to cover all prospective demands for the next 12 to 15 months, but urged a further 25% expansion within the next year and a half. One hundred octane aviation gasoline, Dr. Wilson said, makes it possible to get 20 to 25% more power from a given supercharged engine than

can be obtained on 90 octane fuel such as that available to the Axis powers. This, of course, means great combat advantage.

One petroleum problem that does exist, Dr. Wilson indicated, is the heavy fuel oil supply for the Navy. To solve this problem, he recommended building up reserves of fuel oil on the East Coast.

In reference to the all important subject of what would happen from a petroleum standpoint should America be invaded, Dr. Wilson said: "Using our unequalled system of highways and our wide-spread and efficient gasoline-distributing system, will give the nation a flexible defense system better than several Maginot Lines. Just as one great advantage of cavalry was its ability to live off the country, so the petroleum industry's maze of distribution facilities, bulk plants, and filling stations will help to supply our mechanical horses with the hay they need, especially in so far as the military equipment is designed to utilize the fuels which are generally available."

Summing up, he laid stress on building up stores of fuel oil on the East Coast and increasing gasoline transportation facilities in the same area to make our petroleum security complete.

Jumping to the European war situation, Dr. Wilson said that the answer to the common question "Is Germany short of oil?" is "yes," so far as the broad picture is concerned. This is due largely to the lack of transportation facilities to bring the oil from distant fields, the speaker said. Even though Germany has built super highways, a lack of gasoline makes it necessary to transport most petroleum supplies by train or barge. Poor facilities in Russia, Rumania, and other parts of conquered Europe which supply oil to Germany are hampering progress, Dr. Wilson stated.

However, he made clear that both the German Army and Gestapo have adequate supplies of gasoline for all their operations; that if they can maintain imports of 100,000 bbl a day they can keep the German Army going at its present pace more or less indefinitely; this holds true of the Air Force, too. However, Dr. Wilson said: "In order to keep the Army going it is necessary to short-ration industry and agriculture – that is bound to have adverse effects on Germany's whole economy."

The one petroleum product of which there seems the most serious shortage in Germany is heavy lubricating oils, Dr. Wilson stated. "It has reached a point now," the speaker said, "where they are even installing equipment in industrial plants to recover oil from rags and waste around machinery."

As to the future, Dr. Wilson said that the oil situation will definitely work against Germany for the long pull. Italy, due partly to lack of oil, will be more of a liability than an asset to Hitler from now on, and the increase of English raids will more and more choke off the meager supplies being shipped into Germany over extended, inefficient transportation lines, the speaker prophesied.

DISCUSSION

Harold Nutt, Borg & Beck Division, Borg-Warner Corp., asked if additional pipe lines to the East Coast are contemplated, and Dr. Wilson said: "Yes, they are," reiterating that such lines already would have been completed had they not been blocked by the action of certain Southern legislatures. Only about 3% of East Coast gasoline has been coming via pipe line, Dr. Wilson explained, and an additional 3% may be accommodated by certain revisions and accelerated use of existing facilities. Additional pipe lines offer the only satisfactory solution, however, according to Dr. Wilson.

Widespread use of diesel engines would help the East Coast gasoline situation only to the extent that it would reduce the actual number of barrels of petroleum consumed, Dr. Wilson said in answer to a question from B. B. Bachman, Autocar Co. The problem is just one of saving transportation, he emphasized. By the time any major changeover of equipment could be effected, Dr. Wilson thought, the needed pipe lines and additional tankers long since would have been completed.

Disavowing any claim of being a military expert, Dr. Wilson mentioned three possible reasons why the British have not seriously bombed the Rumanian oil fields: (1) There are much nearer objectives where bombing will bring more important results; (2) an oil field itself does not offer a particularly vulnerable objective; and (3) since transportation difficulties already have made it hard for the Germans to get Rumania's full production into Germany, it is more feasible to strike at transportation facilities than at the fields themselves.

TRUCK AND BUS SESSIONS

Chairmen

L. R. Buckendale **H. T. Woolson**

Recent Tank Engineering Developments and Problems – BRIG.-GEN. G. M. BARNES, U. S. Army.

AMERICAN tanks will travel much faster than any European tanks, including the German, Gen. Barnes announced, and added that our Ordnance Department has outdistanced the world in the development of tank tracks. "In this country," he said, "we no longer talk of track life in hundreds of miles, but rather in thousands of miles. Approximately ½ hp per ton per mph is required to drive an American tank, and the hp to weight ratio is normally kept at about 18 hp per ton.

The clutch problem, according to Gen. Barnes, eventually will be solved through use of a type of transmission which permits elimination of this unit. We have under development or consideration several types of electrical and hydraulic variable speed transmissions, from which, he believes, will come solution of the major power train problem.

Nearly 60% of our tank parts originate in the automotive industry, Gen. Barnes said, stressing the fact that our production of light tanks already has reached such a satisfactory point that "no shortages can possibly occur under any emergency situation." Medium tank output was delayed a few months by design changes made to incorporate lessons learned from the fighting in Poland, Holland, and France, but this delay has resulted in making it possible to build in quantity for the U. S. Army "a very superior vehicle."

Designs for the new heavy tank have been completed and the first vehicle will be ready for test in July, Gen. Barnes revealed. This vehicle involves many new features, he said, and has been a very interesting automotive problem because the engine used has approxi-

Brig.-Gen. G. M. Barnes

mately 1,000 hp – requiring the development of special types of transmissions.

Although British military writers have been strong advocates of the use of tanks, the Germans are the only nation which has put them into full practical use, Gen. Barnes said, pointing out that the Germans have amply demonstrated the importance of tanks to successful military operations.

Designing a tank, he explained, is a problem of making satisfactory compromises between the various conflicting characteristics of the vehicle, and is necessarily based upon military requirements. The basic military requirements to be considered are: armament; armor protection; mobility; weight; number of men in crew; and speed of production. All of these characteristics are dependent, one upon the other.

Armament, Gen. Barnes said, must perform four tasks: armor piercing, high explosive, automatic, and anti-aircraft. It is difficult to combine all these functions in one tank.

Armor protection, he added, is the greatest weight factor in the tank. Three types are used: rolled face-hardened plate, rolled homogenous plate, and die cast.

Due to the high development of the automotive industry in this country, American tanks have a higher horsepower-weight ratio than those of any other nation, Gen. Barnes stated, and revealed that the difficult problems of steering, power train and tracks have all been solved in tanks now being built for our Army.

Concluding, Gen. Barnes emphasized that the United States Army is greatly indebted to the SAE Ordnance Advisory Committee, of which Col. H. W. Alden has been chairman. During the past twenty years, he said, this committee of prominent SAE engineers has worked unceasingly to assist the Ordnance Department in the development of tanks and other types of combat vehicles. This country is fortunate in this emergency to have available to it the great American automotive industry.

DISCUSSION

Questioned as to the vulnerability of the track on modern tanks, Gen. Barnes stressed a previous statement that any tank can be put out of action by anti-tank guns. The tracks will withstand quite severe blows, he said, but a lucky direct hit will put them out of commission.

The crew inside the tank is not affected at all when a shell strikes the outside of a tank, Gen. Barnes replied to another question, unless it actually penetrates the armor.

Procurement and Testing of Military Motor Vehicles – Capt. J. E. ENGLER, Quartermaster Corps

THE development of a military motor vehicle is an interesting story because it shows how careful the Army is to encourage every possible new idea and assistance, Capt. J. E. Engler, Quartermaster Corps, told the Truck & Bus Session Tuesday morning. He traced the development of a theoretical vehicle from its birth until it was delivered to the field.

The idea for the development of a proposed vehicle may originate in the battle field, in the experimental sections of one of the Army branch boards, or in the Motor Transport Engineering Division of the Quartermaster General's Office at the Holabird Quartermaster Depot. The branch board is a group of technically qualified officers with wide field experience appointed by the chief of the branch and charged with the responsibility of developing and testing arms and equipment pertaining to their branch. "We must take off our hats to the numberless engineering accomplishments achieved and contributed by you, gentlemen of the motor industry.

"Regardless of where it originates, a great deal of the burden of any development eventually falls on your shoulders – which is both correct and necessary," he said.

Assuming that this new vehicle has been approved in principle by a branch board of officers, the tentative military characteristics then go to the Quartermaster Technical Committee for study.

When the military characteristics are approved by the technical committee, they are sent to the Secretary of War. Upon his approval, these characteristics are sent by the Quartermaster General to the Motor Transport Engineering Division at Holabird, with a directive that specifications be prepared. It is then the job of the Engineering Division to write a specification that will assure a vehicle that will include in every detail the military characteristics.

The detailed specifications, he said, after reading a paragraph, are based on the results of the standardization work of the Society of Automotive Engineers. "Because of the technical advice, untiring efforts, and wide contacts with the motor industry that the Society has offered us we have been successful in accomplishing this standardization.

1 – SAE President A. T. Colwell, Major D. G. Lingle, Member, Permanent Working Committee, Aeronautical Board, and SAE Past-President Arthur Nutt

2 – Harold T. Youngren

3 – Carl M. Kaltwasser

4 – Dr. George W. Lewis

Rothrock Receives Horning Memorial Medal

DR. A. M. Rothrock, National Advisory Committee for Aeronautics, received the 1940 Horning Memorial Medal, awarded annually by the Society of Automotive Engineers to the author of the best paper presented at an SAE meeting relating to the adaptation of fuels to internal-combustion engines or the adaptation of internal-combustion engines to fuels.

The presentation took place at the Society's 1941 Summer Meeting, White Sulphur Springs, West Va., June 4. J. B. Macauley, Jr., chairman of the 1940 Horning Memorial Medal Board of Award, and a vice president of the SAE, presented the medal.

Dr. Rothrock, who is senior physicist with the NACA, received the honor for his paper, "A High-Speed Motion-Picture Study of Normal Burning, Knock, and Preignition in a Spark-Ignition Engine," which he delivered before the Society's 1940 National Aeronautic Meeting, held in Washington, D. C., March 14.

"It is due to your efforts that items such as these have been reduced to a minimum in all types of military motor vehicles. Interchangeabliity of such parts is no small item toward successful field maintenance of a large fleet and successful maintenance we must have to keep a modern army in combat."

After the detailed specifications have been completed they are sent to the Assistant Secretary of War who is charged by law with responsibility for all War Department procurements. After review and approval, they are returned for file to the Procurement Division at Holabird awaiting the procurement requisition, he said.

The Quartermaster General each year submits an estimate of funds required for the coming fiscal year to the Secretary of War. If funds are not available, it would be necessary to obtain a special appropriation from Congress.

The Quartermaster General's office then makes up a procurement requisition which states the number of vehicles to be purchased, the funds which are available to be used, the destinations to which the vehicles are to be shipped, and other pertinent data. This procurement requistion is then sent to the Procurement Division at Holabird. Upon receipt of the requisition the bid forms are made up, which contain information as to delivery dates, guarantees, etc.

A pilot model must be made by the successful bidder and sent to Holabird for an acceptance test. While final production cannot be started until the acceptance of the pilot model, the manufacturer usually has to start his preliminary work, such as allotting sub-contracts and tooling up, immediately upon receipt of the contract which follows the acceptance of his bid and approval by the Assistant Secretary of War. Otherwise, he might not be able to meet delivery requirements.

The pilot model goes first to the laboratory for a technical and engineering inspection. Dimensions, types of accessories, general construction, wheel clearances, cooling ability are checked and dynamometer tests are made. Cooling ability which is specified as so many degrees cooling differential is carefully measured because military vehicles may be called upon to operate under all types of weather conditions.

After the completion of the field operating test, the vehicle is disassembled and the parts are inspected for wear and fractures. The engine is removed, dynamometer tested in its existing condition and again after tune up.

In the tests at Holabird, no deliberate effort is made to damage the vehicle by colliding with stumps, trees and rocks, which in normal operation the good sense of the driver can be relied upon to avoid. However, he admitted, the tests are severe.

At the completion of the pilot model inspection and test, a conference is held by the various engineers engaged. Usually the manufacturers' representatives are present. Defects are carefully studied to eliminate those that were not the fault of the equipment. Suggestions are made as to changes and the manufacturer is formally notified of corrections that must be made.

"We are more than glad to receive suggestions for its improvement and to consider criticism of its present set-up. Our position is in some respects analogous to the vehicle manufacturers' proving grounds; we must not only find faults but we must also correct these faults.

"Here the analogy ends, as time enters the picture in our case. Time is a vital factor and we are constantly fighting time to preserve thoroughness. We know that if a truck hits a stump hard enough a broken axle will result. We also know that some of our tests damage units that might stand up for the life of the vehicle in field operation," he said.

DISCUSSION

Col. Herbert W. Alden, whose experience with army procurement spans both emergency periods, declared that wholehearted cooperation of army officers and engineers has reached a new high level. "Everywhere I go I see just the kind of cooperation the Captain spoke of," he said. "I can't emphasize this too strongly, because there are those who picture the opposite condition. This is not only the Army's war and the Navy's war, but it is ours – all of ours. And the sooner everyone in this country realizes it, the better off we will all be," he said.

Praising the Quartermaster Corps' success in reducing the number of tire sizes to four, James E. Hale, Firestone Tire & Rubber Co., declared that there is much more to be done by the military services in this respect. He reported that directional treads had proved to be more effective in pulling out of mud than other tread designs.

B. W. Keese, Wisconsin Axle Division, Timken-Detroit Axle Co., remarked that the Holabird Depot must not only procure vehicles available from industry, but must keep them sold to the military services. He suggested, however, more intensive effort be put on training army drivers, and believed that movies and a lecture course for soldiers precede the driveaways from the factory.

L. R. Buckendale, Timken-Detroit Axle Co., commenting upon the Captain's paper and Mr. Keese's discussion, called attention to the need of rare judgment in differentiating between a test which would break up a vehicle in a short time, and a test which would simulate operating conditions. "It is extremely necessary to emphasize the importance of training soldiers to drive because operating a military vehicle differs as much from

driving a commercial vehicle as driving a commercial vehicle differs from driving a passenger car."

C. J. Bock, Yellow Truck & Coach Mfg. Co., congratulated the Quartermaster Corps, and particularly Camp Holabird personnel, for their expeditious procurement and testing a large number of trucks during 1940 and 1941. Holabird tests were of necessity accelerated tests in which a great deal of shock life and wear life were crowded into a few miles. He said the interpretation of such tests, as compared to actual field service, was naturally difficult until an experience factor has been developed.

This is now being developed by the military services and Holabird in long-time tests which approximate conditions to be expected in field service.

"Most of us have observed tests conducted by the military services which also must be classed as accelerated tests. Some have been comparative tests between various types or sizes of equipment. In these also, considerable judgment must be used in evaluating results," he said.

Where comparative results are desired, it was essential that conditions should be as nearly equal as possible, he believed.

For example, he said, "Where floatation or ability to negotiate swampy terrain is being determined, the vehicles should not be placed in a single file column, because after the first few vehicles have gone through a given bad spot, one vehicle may become stuck and in trying to extricate itself may plow up the roadway so badly that none of the others can negotiate it, with the result that conditions are no longer comparable and the test is no longer a criterion of the ability of the remaining trucks.

"Recently, in a test I witnessed, the officer in charge asked each driver if he was in proper gear and front drive engaged. But when vehicle was put through a soft place or up a steep grade, the engines were frequently stalled due to use of improper gear ratio or rear wheels cone-spinning due to not having front-axle drive engaged."

His observation was that the greatest weakness in the motorized truck end of the Army is lack of good drivers. Apparently the thought prevails that a truck and passenger car are similar; and since a passenger car is so simple to drive, no particularly serious instruction is required for truck driving.

"This thought must be overcome as the best Army trucks in the world are only as effective as the ability of their operating personnel. The need for driver instruction cannot be over-emphasized," he said.

Around the golf score board

Merrill C. Horine, Mack Mfg. Corp., said: "Careful reading of Capt. Engler's paper cannot fail to impress one who was familiar with the procedure in the last emergency with the progress which has been made, not only in the straightforward efficiency of the organization for procurement and testing; but in the practical approach to the engineering and tactical problems involved. Nevertheless, some aspects of Army truck procurement do not appear to be streamlined sufficiently to avoid the terrific handicaps under which the army works in peacetime."

The open-specification competitive bidding system is an essential feature of ordinary government procurement, when the volume of materièl to be secured is relatively small, the time element is not a vital consideration and the functions of the equipment in use are neither arduous nor critical, he said. "But in the face of a supreme emergency it might be expected that the need for the highest quality and adaptability of the vehicles, the necessity of conserving to as large an extent as possible the efficiency with which industrial production is carried on and above all the urgency of the whole defense program would transcend all other considerations. Surely competitive bidding and open specifications have no proper place in our present scheme of things."

The public has been led to believe that negotiated contracts are the present procedure in military procurement and that this means the outright purchase of material upon specifications drawn with the sole idea of assuring to the Army the vehicles most perfectly adapted to their several purposes which it is practicable for industry to produce, at prices which are reasonable and fair as determined by negotiation between qualified representatives of both parties, he said. "Certainly it must be recognized that if the industrial establishment is to be employed most effectively, with the minimum waste of material, manpower and above all, TIME, then specialization must become the order of the day. Duplication of effort is to be avoided."

Against these obvious needs, he was shocked to find that the Army still is obliged to temper its specifications in such manner as to facilitate competition among multiple sources of supply, regardless of the extent to which these open provisions may complicate the supply and repair problems and limit the perfection of the designs. "It is astonishing to find that on practically every purchase, invitations to bid are distributed to a plurality of possible bidders, regardless, to some extent, of their relative ability to produce, the items upon which they may have worked previously or on which they are then working and that the awards are made in some cases on the basis of price despite the expressed preference of the using services for the products of other bidders whose prices are justifiably higher."

Wholly aside from the competitive waste which this imposes upon industry, this policy inevitably operates to delay production and involves an expenditure of valuable time, machine-hours and man-hours to no purpose whatever, he said. Change of source of supply on each successive order involves a costly and time-consuming duplication of engineering, tooling, shop arrangement, dies, patterns, etc., in the plants of successive contractors which might far better be employed in needed new development or in augmented production.

"Long since the Army gave up the idea of universal

Some Typical Groups

1 – Ernest Lamb, Edward Clissold, and R. G. Bradley

2 – Charles Hollerith, Frank Jardine, and James J. Cooper

3 – Burton W. Elgin, Edward D. Herrick, and J. F. Cast

4 – Lee Oldfield, Arthur W. S. Herrington, F. R. Speed, and Harry W. Boord

5 – Howard Oppe, A. Chant Owen, and Edward D. Herrick

6 – J. B. Macauley, Jr., James C. Zeder, and Harry T. Woolson

interchangeability of all components of motor vehicles; while in a few assemblies it has tenaciously clung to fixed designs, requiring competing bidders to furnish such identical units. Yet where the re-order without competition of complete vehicles permitted standardization with respect to individual types and sizes of complete vehicles, it has nevertheless insisted upon needless competition which destroyed much interchangeability which would otherwise be secured.

"So splendid is the set-up under which the Quartermaster's Department is now carrying out the motor-vehicle procurement program that it seems a pity that this one remaining carry-over from peacetime practice is still permitted to hamper the motor-truck industry in giving the most effective cooperation," he concluded.

AIRCRAFT-ENGINE SESSIONS

Chairmen

Robert Insley **Carlton Kemper**

Public dissection of a Mercedes-Benz engine taken from a Messerschmitt fighter plane shot down by the British, at the first of two Aircraft-Engine Sessions revealed technical details of such features as automatic mixture control, solid fuel injection, and fluid supercharger drive. Solutions to engine-design problems caused by drastic increases in the lead content of fuels for light plane engines were discussed at the final session, and aircraft-engine men were brought up to date on the design, performance, and future possibilities of combustion gas turbines.

Design Features and Performance Characteristics of the Mercedes-Benz DB-601A Aircraft Engine – RAYMOND W. YOUNG, Wright Aeronautical Corp.

"THE basic design of the Mercedes-Benz DB-601A aircraft engine incorporated into an X-type engine may well be the 2400-hp powerplant recently reported to be under construction in Germany," Mr. Young suggested in his analysis of the engine which powers major striking units in the German *Luftwaffe*. Several DB-601A Mercedes-Benz aircraft engines have been made available in this country for study within the last few months, he explained early in his talk. The unit described in his paper, he continued, was built by the Niedersächsische Motorenwerke of Braunschweig which is probably a licensee of the Daimler-Benz A.G.

Reviewing the development of this engine Mr. Young noted that in 1933-34 Daimler-Benz introduced a 16 cyl V-type water-cooled diesel airship engine of 900 to 1200 hp which saw active service in the *Hindenburg*. Worldwide publicity was directed to the DB-601, he said, when on April 30, 1939, Flight Captain Wendel established the existing world's speed record of 469.2 mph in a Messerschmitt Me109 powered by a DB-601 engine. It is reported, he added, that these particular DB-601 powerplants were special "souped-up" versions which were boosted to produce 1800 hp at 3500 rpm in contrast with the normal maximum of 1050 hp at 2400 rpm for the standard engine. Concluding his chronological review of the engine's evolution, he emphasized that this development of a military powerplant involved a span of ten years and, like similar technical accomplishments in other countries, it was not brought about overnight.

Quoting specifications he brought out that the Mercedes-Benz DB-601A engine is an inverted 60-deg V-type, 12-cyl in banks of 6, liquid-cooled Otto-cycle engine with fuel injection. Its bore and stroke are 150 x 160 mm; its displacement is 2070 cu in.; and its compression ratio is 6.74:1.

Comparing the physical and performance characteristics of the engine with contemporary American, British, French, and German powerplants of the same general design, Mr. Young reported that German and French liquid-cooled designs tend toward larger displacement and lower crankshaft speed while American and British practice favors higher engine speeds with relatively smaller piston displacement; that the Germans favor the inverted type of construction in in-line engines because of the excellent visibiltiy which this type of engine permits in a single-engine airplane; and that American and British engines average about 5.7% higher in bmep under military rating.

Discussing workmanship and quality of finish in his conclusions, Mr. Young pointed out that no useless effort in man-hours or finish has been expended where there is not a direct return in increased reliability and performance, and that handiwork in the polishing of stressed parts is of the highest order. Although stating that the design represents good mass-production practice for military aircraft engines, he noted that the highly stressed bolts do not have ground threads. On the important factor of performance, he summarized: "Despite wishful thinking to the contrary, the performance of the DB-601A with respect to sea level and altitude output, fuel consumption, and weight, seems to be on a par with contemporary powerplants of the same general type." With reference to materials he reported that, "with the possible exception of nickel, there is no appreciable evidence that, at the time this engine was constructed, any shortage of tin, chromium, tungsten, and so on, existed for the German aircraft industry.

"One of the unique, and perhaps the most interesting, feature of the engine," Mr. Young believes, "is the supercharger fluid drive system." He then described the construction and operation of this system, quoting test results as compared with the Wright Cyclone supercharger.

The major part of Mr. Young's paper consisted of a teardown inspection of the engine with detailed descriptions and comments on some of the design features of major component parts, followed by a check of the magnaflux inspection method, analysis and comparison of materials, and comparison on quality of finish. Various parts of the engine were on exhibtiion in the session room.

DISCUSSION

Prefacing Mr. Young's presentation, Chairman Insley pointed out that the investigation reported in Mr. Young's paper was undertaken jointly by Wright Aeronautical Corp. and Pratt & Whitney Aircraft, and that features of the engine accessories studied at Pratt & Whitney would be explained in prepared discussion by W. H. Sprenkle and E. K. Von Mertens of that company.

Mr. Sprenkle gave specific details of the solid fuel injection system used on the DB-601-A engine with the aid of schematic charts and X-ray photographs of various parts. In his explanation of its complex automatic mixture control, he discussed the design and operation of such elements as transfer pumps, de-aerator, priming nozzle, and temperature and altitude compensators. "To obtain this mixture control system," he commented, "the Germans apparently have lumped together a number of previously developed regulating units, producing a highly complicated but actually workable system."

Comparing the gasoline injection fuel pump and nozzle with current commercial diesel injection equipment, he quoted from a report of an investigation made by the American Bosch Corp.: ". . . it is apparent that this gasoline injection equipment does a fairly good job and, although conventional diesel injection equipment has been used as much as possible, considerable thought has been given to reducing size and weight and providing features that assure long life. The workmanship is generally excellent, especially manifested in the smooth motion of the control rod."

"The ignition system of the Daimler-Benz 601-A engine is outstanding in three regards – compactness, lightness, and simplicity of service," Mr. Von Mertens reported. Before comparing this system with American magnetos and distributing systems, he pointed out that the aim of the Germans was to build an ignition system for a certain military engine designed for quantity production to be used for a strictly offensive war. They had the advantage of starting from scratch, he explained, and to satisfy a single procuring agency. Their greatest disadvantage, he added, was lack of materials; the intention from the be-

ginning was to freeze the design as soon as a satisfactory system was developed.

Discussing the magneto, Mr. Von Mertens brought out that it weighs only half of a comparable magneto used in this country, but its maximum output also is only half that of American magnetos although sufficient for the German engine. Outstanding in the design of the magneto, he continued, are the thin-wall aluminum-alloy castings, specifying that the shield cover casting is 0.095 in. thick and the thinnest section on the breaker outlet box is only 0.070 in. thick. Turning to ease of servicing, he explained a number of clever means employed to prevent loss of small parts during disassembly. He pointed out that all screws not necessary to be touched by service men have a dab of white paint covering the slots of the screws. Mr. Von Mertens went on to discuss details of the spark plugs, harness, and cable.

Light Airplane Engines and Their Fuel Problems –
CARL T. DOMAN, Aircooled Motors Corp.

LIGHT plane engine makers recently have been faced with the problem of the entire rearrangement of the fuel situation based on the national emergency, Mr. Doman pointed out early in his pre-

In Action Between Sessions

1 – D. G. Roos, Edward C. Newcomb, and William B. Stout

2 – Ralph Baggaley, Jr., Edwin S. Hall and Gordon Brown

3 – B. Frank Jones, and A. Vance Howe

4 – W. S. James, Harry C. Mougey, and John R. Sabina

A Few Who Took Active Part in Sessions and Committees

1 – Harold E. Churchill
2 – Arthur W. S. Herrington
3 – Ferdinand W. Marschner
4 – Lt.-Col. M. B. Chittick
5 – Fred B. Lautzenhiser
6 – George Walker and Earl H. Smith
7 – Robert N. Janeway

sentation. This revision has not gone into effect 100% as yet, he explained, but fuels of 65, 73, 91 and 100 octane number will be used eventually, eliminating those of 80, 87, and 95 octane number. In the original specifications, he went on, 65 and 73 octane fuel contained no lead, with 80 octane fuel containing 0.5 cc of lead; under the re-arrangement, many fuels have a maximum of 1 cc or more of lead.

This proposed revision of fuel specifications presents a serious problem for the designers of light airplane engines where the customers are demanding increased power at no increase in cost or weight, Mr. Doman explained, especially where engines were designed and developed to operate on not more than ½ or 1 cc of lead. In the major part of his presentation, he pointed out the effects of using greater proportions of lead and the attempts to alter the engine design to permit the use of higher leaded fuels without seriously increasing the weight or cost of the engines.

The use of dual carburetion on a 6-cyl opposed type of engine, Mr. Doman believes, is the simplest method of approach for the time being. On the other hand, he emphasized that the designer of the light plane must better appreciate the necessity of better

cooling and pay more attention to details in the installation if he is to do his part in obtaining the maximum efficiency from the engine.

The principal objection to the use of automotive fuels seems to come from possibility of vapor lock and indefinite knock rating, he explained after pointing out that at present there are no gasoline airplane engines in this country approved for use of a fuel other than aviation grade. "There is no more excuse for vapor lock in an airplane engine than there is in an automobile engine where great strides were made to eliminate vapor lock years ago," he contended. He reported that, while no engines made by his company are approved for automobile fuel, four type tests on automotive fuel recently have been completed with no trouble.

DISCUSSION

Referring to Mr. Doman's report that dual carburetion had proved more effective on 6-cyl than on 4-cyl engines, A. T. Gregory, Ranger Aircraft Engines, Division Fairchild Engineering & Airplane Corp., contributed that, in his company's experience, the reverse is true. Builders of light airplane engines, he pointed out, are up against the problem of making them run on the lowest grade of fuel available.

"It looks as though the light plane will have to depend

Talkative Twosomes Were Frequent Throughout the Meeting

1 – J. R. Heller and F. W. Slack

2 – Lt. A. E. Cleveland and Capt. R. M. Jones

3 – Roy W. Brown and Almon L. Beall

4 – Paul H. Oberreutter and Walter R. Griswold

5 – William H. Clark and Austin M. Wolf

6 – B. E. Sibley and Dr. Raymond Haskell

7 – Raymond E. Carlson and Lt.-Col. John K. Christmas

8 – Reginald Cleveland, "New York Times," and E. Y. Watson, "Detroit News"

9 – Arthur W. Pope, Jr. and T. C. Smith

upon automobile fuel," believes A. L. Beall, Wright Aeronautical Corp. Premium automobile fuel can be depended upon, he opined, to give an octane rating by the Motor Method of not less than 80. He recommended that each manufacturer should select a basic fuel for the development of light plane engines and specify the method of knock test to be employed with this fuel to eliminate confusion between the types of aviation and automotive fuels and methods of knock rating as mentioned by the author.

Light plane engines have a long way to go before they have exhausted the possibilities of increasing cooling fin area, pointed out Chairman Kemper. The 17% increase in cylinder-head fin area and 8% increase in fin area on the barrel reported by the author, he contended, is only the beginning.

To clarify the discussion on knock-test methods, Dr. D. P. Barnard, Standard Oil Co. (Ind.), reminded that the ASTM, CFR, and Motor Methods are one and the same, thus the five different methods mentioned by Mr. Doman can be cut to three. Dr. Barnard gave little hope that clear motor gasolines would be available, at least not in the

In and About the Meeting Rooms

1 – John H. Kurlander, Stephen Johnson, Jr., E. A. Wales, and Lt.-Col. Walter C. Thee

2 – W. H. Sprenkle, E. K. Von Mertens, Robert Insley, and Raymond W. Young

3 – L. L. Bower, C. J. Leasenfeld, F. C. Burk, and R. J. Greenshields

4 – Harry T. Woolson, David Beecroft, and Walter T. Fishleigh

5 – William H. Hubner, J. B. Macauley, Jr., S. D. Heron, Dr. Graham Edgar, H. K. Cummings, D. P. Barnard, and Frank Jardine

Midwest. Regular automobile gasoline of about 75 octane number, he said, requires at least 1 cc of lead per gal, and premium-grade gasoline, about 2½ cc.

Replying to a question by G. L. Neely, Standard Oil Co. of Calif., Mr. Doman reported that, in no case had spark plugs been found to be critical enough to the use of leaded fuel to prevent the plane from reaching its destination.

Combustion Gas Turbine Design – J. T. RETTALIATA, Allis-Chalmers Mfg. Co.

PRESENT-DAY gas turbine thermal efficiencies for a non-regenerative cycle are between 16 and 17% with a turbine inlet temperature of 1000 F, the highest operating temperature possible for the materials employed, Dr. Rettaliata revealed in his review of gas turbine design and development. With a regenerative cycle employing a heat exchanger to preheat the compressor discharge air with the turbine exhaust gas, he added, the thermal efficiency of a unit may be increased approximately 50% over the figures just quoted.

Because of the temperature limitations of the materials, he pointed out, real incentives exist for the development of materials capable of withstanding operation at higher temperatures. Laboratory metallurgical investigations now in progress, he reported, indicate that continuous operation at 1500 F is within the realm of possibility. At such temperatures, he explained, the thermal efficiency of a regenerative gas turbine cycle approaches the diesel range, and reduction in unit cost and weight ensues.

The principal commercial application of the combustion gas turbine in this country today, he announced, is in oil refineries employing the Houdry process. Other applications described include turbine-axial compressor units operating as superchargers for the Velox boiler; and a 4000-kw electric generating unit for the city of Neuchatel, Switzerland. Allis-Chalmers, operating as licensees of Brown-Boveri, he revealed, is now studying the possibilities of the gas turbine as a drive for locomotives of large output.

"The cycle of the gas turbine appears particularly attractive for installations lacking water facilities, and it is toward the proper, natural, and favorable application of the gas turbine that present development is being directed," Dr. Rettaliata concluded.

In his introduction he dispelled erroneous conceptions that the gas turbine is a recent invention by pointing out that the earliest device in this category was devised by Hero of Alexandria in 130 B.C., and that patents were taken out in 1791 on a machine bearing an intrinsic resemblance to the modern combustion gas turbine.

DISCUSSION

Intrigued by the possibility of attaining up to 33% thermal efficiency on an internal-combustion engine burning fuel costing 3¢ per gal, aircraft-engine men plied Dr. Rettaliata with a steady stream of questions.

"In the Houdry process we furnish them with compressed air which goes through the Houdry system and comes back to us about 900 F," he told H. T. Woolson, Chrysler Corp., explaining the application of combustion gas turbines in oil refineries using this process. No specific fuel is used as in a power unit, he continued; the burning occurs within the process.

For power units, he told another questioner, Bunker C fuel is used costing 3¢ per gal. Refractories were tried for turbine housing material, he reported, but they did not work out successfully. 18-8 heat- and corrosion-resistant steels are now used for this purpose; a modified form of this steel for turbine blading; and modified 18% chromium steel for the compressor blading, Dr. Rettaliata revealed.

Asked about the amount of excess air employed he reported that 700% more air than is necessary to support combustion goes through the turbine at 1000 F. "By using more heat-resistant materials," he added, "we believe that we can operate the turbines continuously at 1500 F."

Turbine speeds range from 4320 rpm for the largest up to 6000 rpm, he told Austin M. Wolf, automotive consultant. When the load is suddenly released, he replied to Mr. Wolf's second question, a bypass valve is opened that bypassses the gas around the turbine.

A regenerator is now being built, Dr. Rettaliata announced, of 6500 sq ft and 6 ft diameter. He explained that regenerators may be uneconomical for certain installations if the pressure drop through them is too great.

Output is controlled solely by control of the fuel, he told M. J. Kittler, Holley Carburetor Co., explaining that the regulation of the fuel controls the gas temperature through the turbine. To other questioners, he reported that the blades run remarkably clean and that no deposits have formed from running on Bunker C fuel.

Queried about costs by G. H. Freyermuth, Standard Oil Co. of N. J., he quoted $65 per kw as the cost of the combustion gas turbine units. When higher temperatures are attained, he added, this cost will be lower. When it is realized that the gas turbine units are practically complete powerplants, he pointed out, this cost does not seem so high when compared, for example, with the $100 per kw cost of a complete steam station.

Asked about the possibility of cooling the turbine blading, thus permitting use of inferior materials for the blading, Dr. Rettaliata pointed out that this arrangement would be too risky because of the disastrous results following any stoppage of cooling.

The reason for the high efficiency of the compressor, he told Prof. L. C. Lichty, Yale University, is the very small pressure rise per stage.

Envisioning the quiet, vibrationless flow of power possible in aircraft propelled by combustion gas turbines, Dr. George W. Lewis, National Advisory Committee for Aeronautics, announced that he knew of one gas turbine project for powering an aircraft engine. Compressors of greater ratios are needed to supercharge aircraft flying at increasingly higher altitudes, he added, indicating that the axial-flow compressor may be the answer.

Others participating in the discussion included R. N. DuBois, Aircraft Division, Packard Motor Car Co.; Kenneth Campbell, Wright Aeronautical Corp.; and S. D. Heron, Ethyl Gasoline Corp.

Skeet Winners

E. W. Griffith, runner-up, and J. A. Gelzer, winner

PASSENGER-CAR & BODY SESSIONS

Chairmen

K. M. Wise **W. T. Fishleigh** **E. H. Smith**

The critical materials picture looked a little brighter to many passenger-car engineers at one session after figures of mounting production quoted by critical material suppliers had pierced the fog of uncertainty following a progress report of the replacement work in the automobile industry. In a second paper the various types of automatic and semi-automatic transmissions were analyzed and compared and design trends clarified.

Papers and discussion in another session foreshadowed the dominant influence that fuel economy may have on future passenger-car design trends. Discussion of a paper on streamlining for fuel economy touched off debate once more on the long-mooted point of rear-engine versus front-engine design. Other papers covered such important factors to fuel economy as compression ratios, fuels, engine speeds, vehicle weights, axle ratios, and rolling resistance of tires.

Is It Practical To Streamline for Fuel Economy? – JAMES C. ZEDER, Chrysler Corp.

"THOSE who think of streamlining as a penny saver rather than a performance booster may not fully appreciate the fact that the economies made possible by a reduction in air resistance can be largely nullified by failure to adapt the engine and transmission system to the altered road-load requirements of the vehicle," Mr. Zeder emphasized, developing one of his paper's principal themes. It is practical to streamline for fuel economy, he summarized, if, and only if, the power system is engineered to fit the body. In subsequent discussion, he brought out the quantitative importance of this efficiency change, and set forth the potential gains.

After pointing out that "we have taken a good many little steps" along the path of transforming the "conventional" into the "streamline" body, he explained that these steps "had to be little for in the past all major attempts at speeding up the progress of streamlining have met with the determined opposition of competitors and tardy public acceptance." Reviewing developments in streamlining he brought out that "sun visors retreated within the body ten years ago . . . . windshields have acquired more rake year by year . . . . the spare wheel was first boxed in and then the luggage rack was thrown away . . . . fenders gradually evolved from wind slicers to guiding surfaces for the air stream . . . . headlamps developed streamlined tails and finally disappeared into the fenders . . . . bumpers are being admitted from associate to full membership with the car."

The economies to be realized from streamlining, Mr. Zeder declared, come from the lower horsepower required to maintain any given speed. He showed mathematically that the power required to accelerate is not affected directly. In any case, he warned the designer should be certain that his streamlined body design is no heavier than the body that it replaces since a heavier streamlined design easily might fail to show the expected improvement in tank mileage because of additional power required to handle the greater mass during periods of acceleration.

To translate streamlining into increased fuel economy, Mr. Zeder concluded, requires: (1) that the weight of the car be kept down to normal and (2) that a transmission be used which maintains the engine thermal efficiency at a satisfactory level in the high-speed range and yet does not reduce car activity at lower speeds.

Throughout his presentation, Mr. Zeder emphasized the importance of car weight and cross-sectional area, as well as the necessity for maintaining the accelerating ability of the streamlined car along with its improved economy. He quoted test-car results in his treatment of the present state and future limitations of streamlining as a source of economy.

DISCUSSION

The practical value of streamlining as an important part of economy programs and its influence on safety were emphasized in discussion.

The prepared discussion of H. P. Chalmers, read by David Beecroft, Bendix Products Division, Bendix Aviation Corp., gave the views of one of the pioneers of automobile streamlining. "There is being made today," he pointed out, "a saving of several hundred millions of dollars' worth of gasoline through streamlining in spite of the fact that many attempts at streamlining have been made by artists, engineers, and advertising men who are lamentably ignorant of the rudiments of the science of aerodynamics."

Mr. Chalmers branded as false current talk of streamlining being efficient only at very high speeds, and declared that such unfortunate misapprehensions have done much to hold back progress in streamlining.

Confirmation of some of Mr. Zeder's test results was reported by E. H. Smith, Packard Motor Car Co., the next discusser. In a 600-mile test, he said, a 17% increase in fuel economy and an increase in top speed from 88 to over 94 mph were obtained through streamlining. E. S. Hall, Round Engine Patents, also reported corroboration of Mr. Zeder, pointing out that he emphasized the necessity for combining streamlining with a suitable transmission in a paper which he presented in 1933. He concluded by suggesting a "dream engine" in the form of a variable-stroke constant-speed gasoline engine as a means of improving fuel economy. He indicated that development of such an engine is in the realm of possibility.

"Plenty of tests have been run," contended Walter T. Fishleigh, consulting engineer, to show that the 51% improvement in fuel economy indicated by Mr. Zeder can be increased to a 100% improvement by putting the engine in the rear. He suggested that, if passenger-car engineers would "sneak the engine down under the chassis into the luggage department or tail, the public would never know the difference." Then, he averred, engineers would at last have an opportunity for an "all-out attack on fuel economy." He brought out that, although streamlining has advantages even at 30 mph, its real benefit comes at cruising speeds around 60 mph. Mr. Zeder is the first large production man to admit the practical possibilities of streamlining, Mr. Fishleigh concluded.

Taking issue with Mr. Zeder's statement that the public "will tolerate no change too rapid for its limited powers of assimilation," Lee Oldfield, Schwitzer-Cummins Co., contended that "we don't know what the public won't take until we try," and urged passenger-car engineers to design vehicles that they honestly believe are best for the public, and then sell the public on the idea that they are best. He deplored present trends in accident rates and charged engineers with the responsibility for "taking safety seriously and honestly."

After displaying a chart that portrayed the "travail of power flowing from the cylinder to the rear wheel," Prof. W. E. Lay, University of Michigan, showed the economies made possible by controlling car speed with the transmission instead of by the throttle. He showed by means of charts that there is one speed at which the greatest excess power is available for each gear. "The aircraft people have stolen a march on the automobile industry with their variable-pitch constant-speed propeller," he concluded.

Although recent styling trends have resulted in lowering the resistance coefficient or *K* factor for a given frontal area, contributed Ernest E. Wilson, Proving Ground Section, General Motors Corp., the frontal areas have been increasing in such a way that the overall resistance has remained nearly the same. Consequently, he pointed out,

any economy gain from such improvements has been obtained only in an indirect way.

Tests at General Motors Proving Ground, he reported, have shown a decrease in the drag or resistance coefficient of the same order as that found by Mr. Zeder. Tests on several 1940 four-door sedans, he continued, showed that the average K value was 0.00125 and that the minimum in the group tested was 0.0011. He explained that these values were obtained from towing tests.

If economy gains are to be realized from streamlining, Mr. Wilson pointed out, it is important: first, to peg the car performance, that is, accelerations must remain the same; second, the weight of the car must not be increased; and third, as Mr. Zeder has pointed out, if the K factor is decreased, the frontal must not be increased proportionately. He concluded by stressing another important point brought out by Mr. Zeder: that no sacrifice of stability, especially at high speed, can be tolerated from the safety angle.

Engineering for Better Fuel Economy – H. T. YOUNGREN, Olds Motor Works Division, General Motors Corp.

"THE real economy factors," Mr. Youngren concluded, summarizing the results of his analysis, "are reduction of engine speed, lighter-weight cars, and the economical and general availability of higher octane fuels to permit the use of higher compression ratios." In his paper he reviewed the experience of his company in developing its products to give better fuel economy. "Even though the weight of our cars has increased and the hill performance has improved, gains in miles per gallon nevertheless have been accomplished," he reported.

The most progress during recent years in improving fuel economy, and the best hope for future improvement, Mr. Youngren averred, lies in the factors affecting the brake thermal efficiency of the engine. Higher compression ratios, he believes, will continue to be contributing factors to better fuel economy; ratios of 8:1 or higher are possible when gasoline of the necessary octane ratings are made commercially available. He emphasized that the proper choice of performance factors is required to obtain maximum economy from higher compression ratios and higher octane fuels. For example, to get the real benefit in economy from increased compression ratio, it is necessary to change the drive ratio to cause lower engine speed.

In a comparison of a small high-speed engine versus a large low-speed engine along with a discussion of the effects of engine friction and mechanical efficiency, Mr. Youngren pointed out that any fuel economy obtained by reducing engine speed really has been due to the reduction of engine friction along with higher throttle operation for a given car speed.

Overall fuel losses of as much as 5% have resulted from boiling out of the light ends of the gasolines in the gasoline tank and in the carburetor due to the high temperatures prevailing in these systems, he revealed, reviewing the results of research on this problem. Attacking another source of power loss – the exhaust system – he showed that removing restrictions and lowering back pressure have resulted in measurable gains in gasoline mileage.

Men's Golf Champion

A. T. Colwell

Men's Golf Runner-Up

C. W. McKinley

The Rolling Resistance of Pneumatic Tires as a Factor in Car Economy – W. F. BILLINGSLEY, B. F. Goodrich Co.; R. D. EVANS, Goodyear Tire & Rubber Co.; W. H. HULSWIT, U. S. Rubber Co.; and E. A. ROBERTS, Firestone Tire & Rubber Co. (Presented by Mr. Evans)

WHEN the motor-vehicle chassis is examined from the standpoint of operating economy, these authors pointed out, it immediately becomes evident that the tires are the predominant, if not indeed the only, chassis parts which consume appreciable amounts of power. Presenting the available data relating to the power consumed and converted into heat within the material of the tire itself, they showed that the rolling resistance of tires is affected by numerous factors as follows:

Rolling resistance is increased by an increase of speed, of load, of rim diameter, of traction, and of slip angle; it is decreased by an increase of inflation pressure, of rim width, and of progressive tire wear. Six-ply tires have higher rolling resistance than four-ply tires; power consumption on gravel roads averages more than twice its value on hard road surfaces; and cotton cord tires have higher rolling resistance than do rayon cord tires.

Elaborating on the various test results, they brought out that, when tires become worn, the deflection is reduced, and less material is subject to flexure. This condition is reflected in a lessened rolling resistance. With the tread about two-thirds worn away, the rolling

(Continued on page 33—following Transactions Section)

About SAE Members

SHERROD E. SKINNER, general manager of Olds Motor Works Division, General Motors Corp., Lansing, Mich., has been honored with an appointment as alumni trustee of Rensselaer Polytechnic Institute – the oldest school of science in continuous existence in America. Mr. Skinner received his M.E. degree from Rensselaer in 1920, having returned to graduate after two years of service in the U. S. Navy during World War I. He assumed general managership of Oldsmobile last August.

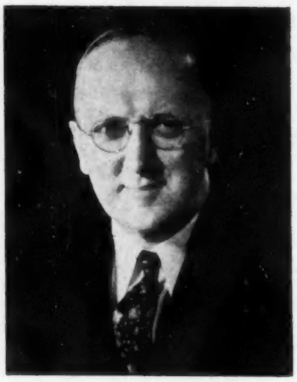
EARL R. HERRING, general manager of Kinner Motors, Inc., Glendale, Calif., has been elected vice president and a member of the board of directors of the company.

MARK E. ZIMMERER, chief engineer and vice president in charge of production, Kingston Products Corp., Kokomo, Ind., has been named general manager of the company.

C. H. DOLAN steps to presidency of Wissahickon Tool Works, Inc., Bala-Cynwyd, Pa. Formerly he was vice president of the Intercontinent Corp., New York.

H. W. GRAHAM, director of research, Jones & Laughlin Steel Corp., Pittsburgh, was elected chairman of the committee on iron and steel of the National Research Council's South American Committee. Mr. Graham recently visited South America as a member of a group of 21 executives assigned to study industrial progress there and make a report for the council which will be submitted to Jesse Jones, Secretary of Commerce.

Committee Chairman



H. W. Graham

ELMER McCORMICK, chief engineer, John Deere Tractor Co., was one of four authors who contributed views on the topic "Some Engineering Implications of High-Speed Farming" in the May issue of *Agricultural Engineering*.

EARL R. KLINGE goes to Pennsylvania State College as diesel engine instructor at the engineering experiment station, State College, Pa. He was formerly associated with the Chrysler Institute of Engineering.

E. J. HERGENROETHER, metallurgist of the Detroit field office of the development and research division, International Nickel Co., Inc., Detroit, has resigned to join the staff of the conservation section, production division of the OPM.

JAMES E. De LONG, president, general manager, Waukesha Motor Co., Waukesha, Wis., was officially appointed assistant chief of the Chicago Ordnance district, at a luncheon given for Mr. De Long by the officers of the district. He will succeed the late C. R. Messinger, former head of Chain Belt Co.

CARL B. SQUIER, vice president in charge of sales of Lockheed Arcraft Corp., Burbank, Calif., said recently, "If America's air force reaches a total of 50,000 airplanes, a replacement capacity of 2500 airplanes a year will be necessary to maintain full strength. An annual replacement of 2500 planes compares favorably with the total industry production of 2141 airplanes in 1939," he pointed out, "but the commercial market will have to keep the manufacturing facilities of the industry in use."

CLAYTON R. BURT, president and general manager, Pratt & Whitney Division of Niles-Bement-Pond Co., officiated at the dedication of the company's new 48,000 ft gage building at Hartford, Conn. The new plant will work on defense orders.

JOHN DAVID WRIGHT, secretary and director of Thompson Products, Inc., Cleveland, has also been appointed treasurer of the company.

J. CALVIN WILSON assumes the post of director and vice president of Thompson Products Ltd., Ontario, Canada. He was sales manager, service division.

Having resigned as automotive engineer, Socony-Vacuum Oil Co., N. Y., **LEROY P. STERLING** has taken the post of ground inspector of aviation engines, Riddle Institute of Aeronautics, Carlstrom Field, Arcadia, Florida.

With the merging of the Sheffield Gage Corp., and The Cimatool Co., to form the Sheffield Corp., Dayton, Ohio, **PAUL W. POOCK** was appointed sales engineering manager, gage and machine tool divisions, of the new company.

JOHN I. CICALA is experimental engineer with the Mawen Motor Corp., New York. He was formerly automotive and diesel engineer, Socony-Vacuum Oil Co., Brooklyn, N. Y.

Life membership in the Automobile Old Timers, Inc., New York, recently was bestowed upon **PAUL G. HOFFMAN,** president of the Studebaker Corp., South Bend. Mr. Hoffman is also vice president, Automobile Manufacturers Association and president, Automotive Safety Foundation.

JOHN LLOYD RICHMOND, test engineer, Cooper-Bessemer Corp., has been temporarily transferred from the company's Mount Vernon, Ohio, plant to its Grove City, Pa., plant.

CLARENCE G. WOOD has resigned as treasurer, director of sales and engineering, Monmouth Products Co., Cleveland, to become president and treasurer of C. G. Wood, Inc., Cleveland.

Appointment of **J. J. BLACK** as vice president in charge of engineering has been made by the Trailer Co. of America, Cincinnati. He formerly was chief engineer with the same company.

V. P. RUMELY has been elected vice president in charge of manufacturing of the Crane Co., Chicago. Mr. Rumely, who has been works manager of the company's Chicago plant, joined the Crane Co. in 1937. Previously he had served as superintendent and factory manager of the Hudson Motor Co. Mr. Rumely was chairman of the Detroit Section in 1937.

V. P. Rumely

M. F. WEILL, field engineer, Ethyl Gasoline Corp., Los Angeles, is now a captain, U. S. Army, in charge of the repair shops for the Ninth Corps Area, located at the Presidio, San Francisco.

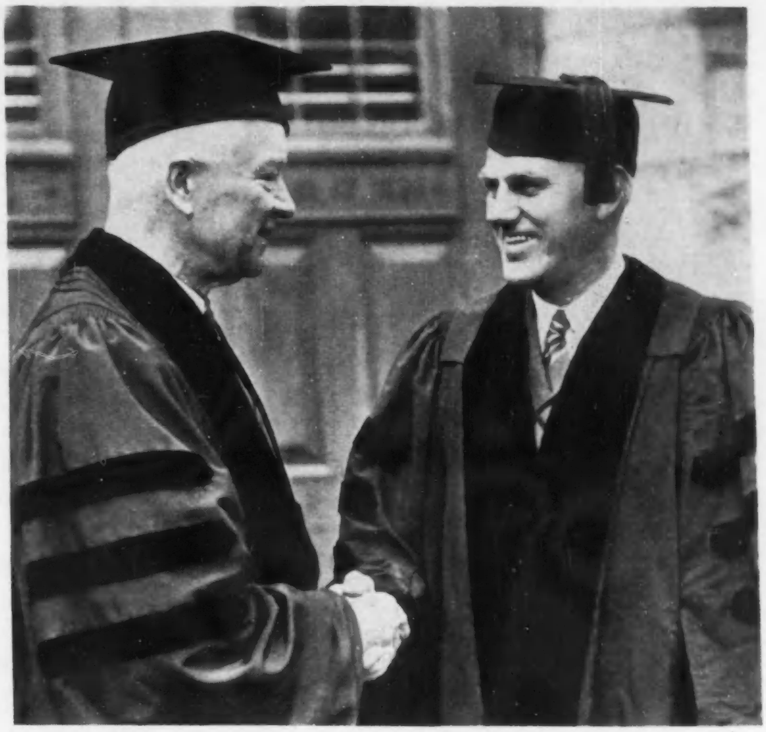
L. L. BEARDSLEE is now transportation officer at Camp Haan, Calif., with rank of major. Formerly he was superintendent, Shops & Garage, of the County of Los Angeles Fleet.

RUSSELL COLDWELL HANSCOM, motor-check engineer, Tide Water Associated Oil Co., San Francisco, and **WILLIAM KESEMANN,** partner, Wilson-Kesemann Engineering Co., Ventura, Calif., have both recently joined the Curtiss-Wright Technical Institute of Aviation, Glendale, Calif., instructing in the engine department.

E. L. CARROLL, eastern advertising manager of the SAE Journal, has been recently elected commander, American Legion Post 52, Scarsdale, N. Y.

HARLOW H. CURTICE, general manager, Buick Motor Division, and vice president of General Motors Corp., will be actively concerned in the organization's aircraft-engine plant now rising on a site in Melrose Park, Chicago. In normal operation the $31,000,000 engine plant will build 500 Pratt & Whitney engines monthly and employ 10,000.

Arthur Nutt Receives D. E. From Worcester Institute



SAE Past President Arthur Nutt, vice president in charge of engineering, Wright Aeronautical Corp., receives the honorary degree of Doctor of Engineering from the Worcester Polytechnic Institute. W. Tyler Cluverius, president of the Institute, is shown congratulating Mr. Nutt. At the same commencement exercises, Harry G. Stoddard, president, Wyman-Gordon Co., was also recipient of a D.E. degree; Robert W. Stoddard, Wyman-Gordon vice president, and Arthur Nutt were elected trustees of the Institute

Announcement of plans for construction of an addition to the Chandler-Evans Corp. plant, South Meriden, Conn., was made recently by **BENJAMIN H. GILPIN,** executive vice president. According to Mr. Gilpin, upon completion of the addition in July, employees at the plant will be increased from 190 to 270.

HYMAN FELDMAN has reported for active duty as assistant motor transportation officer with the 42nd Engineer Regiment, U. S. Army, stationed at Camp Shelby, Miss. He formerly was junior automotive engineer, Capital Transit Co., Washington, D. C.

CARL E. CUMMINGS is serving on the technical staff, U. S. Ordnance Department, Washington, D. C., as reserve captain. Prior to this appointment he was supervisor, research department, Beacon Laboratory, The Texas Co., Beacon, N. Y.

WILBUR CURRIER RICE recently was added to the personnel of the American Locomotive Co., Schenectady, N. Y., as assistant to the general manager of the production engineering department. Formerly he was assistant to the chief tool designer, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

THOMAS J. THOMPSON, a Purdue University student, has joined the staff of Bendix Products, Division Bendix Aviation Corp., South Bend, as engineer.

VERN S. WHITE steps from engine designer, White Motor Co., Cleveland, to project engineer, Aircraft Engine Division, Continental Motors Corp., Muskegon, Mich.

Formerly engineer, Standard Oil Development Co., N. Y., **EDWARD R. GODFREY, JR.,** becomes sales engineer, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

ARTHUR D. MILLER has been called into active service as first lieutenant, 69th Coast Artillery, U. S. Army, stationed at Camp Hulen, Texas. He has been granted leave of absence from his position as safety engineer, Ethyl Gasoline Corp., New York, to serve in the Army.

RUPERT HERL has been added to the personnel of the Bijur Lubrication Corp., Long Island City, N. Y. He was formerly automotive mechanic, Fogarty Bros., Jamaica, L. I., N. Y.

ROBERT L. SUTHERLAND, formerly with Firestone Tire & Rubber Co., Akron, Ohio, has been placed with Borg & Beck, Division Borg-Warner Corp., Chicago, as test engineer in the mechanical laboratory.

DONALD E. LOWMAN, formerly draftsman, Wright Aeronautical Corp., Paterson, N. J., is now sub-foreman, production test department, with the same company, Cincinnati Division, Lockland, Ohio.

P. H. SCHWEITZER, engineering research professor, Pennsylvania State College, engineering experiment station, State College, Pa., is co-author of a 27-page bulletin entitled "Oxygen-Boosting of Diesel Engines for Take-Off." The bulletin chronicles results of an investigation conducted at the diesel laboratory of the Pennsylvania State College. Collaborating with Mr. Schweitzer on this bulletin was **EARL R. KLINGE.**

ROBERT E. HUNT has taken up duty as first lieutenant, U. S. Army, Ordnance Department, Langley Field, Va. Formerly he was connected with Wilkening Mfg. Co., Philadelphia, as experimental engineer.

Upon graduating from the Yale School of Engineering, **WILLIAM B. LEWIS** joined Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

A. VANCE HOWE, goes to Elyria, Ohio, as western manager in charge of manufacturer's sales, Bendix-Westinghouse Automotive Air Brake Co. Formerly he was district manager, Detroit, for the same company.

(About SAE Members continues on next page)

William C. Munson

William C. Munson, 64-year-old sales engineer, American Brakeblok Division, American Brake Shoe & Foundry Co., Detroit, died recently. From 1904 to 1921 Mr. Munson was salesman and branch manager of the Russell Mfg. Co., Conn. He became associated with the Society in 1921.

Lawrence T. Wagner

Lawrence T. Wagner, sales engineer, Standard Oil Co. of Calif., San Francisco, died recently. Born in San Francisco, Mr. Wagner graduated from the University of California with an A.B. degree. From 1910 to 1914, he was manager of auto sales and service, Argonaut Motors Co. Then quickly followed positions with Willys-Overland Co., Standard Gas Engine Co., and finally Standard Oil. Mr. Wagner was 65 years old. He became a member of the SAE in 1927.

Walter S. Cochrane

Walter S. Cochrane, a member of the diesel engineering staff of Chrysler Corp., died May 9 at his home in Detroit. He was 55 years old. A member of the Buick engineering staff for 13 years, Mr. Cochrane joined the Chrysler Corp. in 1926. He became a member of the SAE in 1928, was 1941 chairman of the Diesel-Engine Division of the Standards Committee. In 1940 he was a member of the subdivision that developed the revised Test Code and forms for diesel engines.

WILLIAM LITTLEWOOD, vice president in charge of engineering, American Airlines, Inc., New York, was among officials present when the organization was awarded the Trustees' Commemorative Safety Award from the National Safety Council as result of a one billion passenger-mile non-fatality record. American was the first air transport company to achieve such distinction.

SAMUEL NOOGER is serving as junior mechanical engineer in the Materiel Division, U. S. Army Air Corps, at Wright Field, Dayton, Ohio. Formerly he was junior engineer, Bureau of Engineering, Federal Power Commission, Washington, D. C.

MERRITT L. COLLINS has been appointed assistant to the manager of the gasoline testing department, Ethyl Gasoline Corp., New York. Prior to advancement he was laboratory manager in San Bernardino, Calif., for the same company.

PETER ALTMAN, whose title has been director, technical section, research division, Aviation Mfg. Corp., New York, is now director of the manufacturing research department, Vultee Aircraft, Inc., Detroit. This change of title was brought about by the transfer of the research division, Aviation Mfg. Corp., to Vultee Aircraft, Inc.

JOHN A. GRAHAM, president of Purolator Products, Inc., Newark, N. J., since 1925, has been elected honorary chairman of the Board.

WILLIAM H. WELCH joined the Allison Division, General Motors Corp., Indianapolis, Ind., as designer several months ago. He was formerly checker with the International Machine Tool Co. in the same city.

EUGENE L. WAGNER, formerly owner, Buda Engine & Parts Service, Denver, Colo., recently organized the "Gene Wagner" Auto Electric Co., McMinnville, Ore., sales and service representatives for Autolite, Carter, Zenith, Bosch and Trico products.

CLYDE R. PATON, chief engineer of the Packard Motor Car Co., has been appointed to the State Board of Registration for Architects, Professional Engineers and Land Surveyors. He is the first mechanical engineer to be so honored since the Registration Act 240, P.A. 1937, became effective on Jan. 1, 1938. Mr. Paton was 1938 SAE vice president representing the Passenger Car Activity, a past chairman of the Detroit Section, and

Clyde R. Paton

a member of several SAE committees. He is also secretary of the Engineering Society of Detroit and holds many patents on automotive designs.

The newly developed spin-proof flivver plane "Skyfarer" – second airplane ever built to win CAA recognition as being "characteristically incapable of spinning" was built under patents held by SAE member **FRED E. WEICK.** Mr. Weick also holds patents on the first non-spin "Ercoupe."

EDWARD M. GREER has been appointed aircraft hydraulic engineer, Simmonds Aerocessories Corp., New York. Previously he was assistant chief engineer, aircraft division, Electrol, Inc., of the same city.

DON R. BERLIN, director of military engineering, Curtiss Aeroplane Division, Curtiss-Wright Corp., Buffalo, was among the passengers from Lisbon who arrived on the Pan American Airways flying boat, *Atlantic Clipper,* at LaGuardia Field, June 4.

THOMAS C. LEAKE, owner of a company which operates under his name, has become temporarily affiliated with the British Purchasing Commission.

NORMAN L. DEUBLE, formerly assistant to vice president, Copperweld Steel Co., Warren, Ohio, has been named manager of sales. Mr. Deuble is a graduate of the Case School of Applied Science with the degrees of B.S. and Metallurgical Engineer; he is a member of the present SAE Iron and

Norman L. Deuble

Named Manager of Sales

Steel Committee. Before joining Copperweld he was with Republic Steel Corp., Central Alloy Co., and United Alloy Steel Co.

Among the officers re-elected at the annual meeting of the Automobile Manufacturers Association, Detroit, were: **ALFRED P. SLOAN, JR.,** vice president; **PAUL G. HOFFMAN,** vice president, passenger car division; **ROBERT F. BLACK,** vice president, truck division; **PYKE JOHNSON,** executive vice president; **ALFRED REEVES,** advisory vice president; and **BYRON C. FOY,** secretary.

C. L. STEVENS, Ford Motor Co., has been added to the personnel of the SAE Aircraft Engine Materials and Processes Committee, and **R. R. MOORE,** Naval Aircraft Factory, has been added to the Airframes Materials and Processes Committee.

Packard's manager, customer relations, **PAUL L. DUMAS,** is one of two supervisors of the marine training school organized by that company. Packard has been asked by the U. S. Navy to instigate a training program for the enlisted personnel necessary in the operation of marine engines in active service.

C. L. HALLADAY is now manager, Jackson Bumper Division, Houdaille-Hershey Corp., Jackson, Mich.

E. R. LEDERER is now affiliated with the Sun Oil Co., Philadelphia, Pa., as consulting engineer. He was formerly president and general manager, Bradford Oil Refining Co., Bradford, Pa.

Sales Manager

George W. Davies

GEORGE W. DAVIES, formerly Detroit sales representative, Sealed Power Corp., has been named sales manager, original equipment division, Muskegon, Mich.

W. J. BENNETT, formerly car foreman, Illinois Central Railroad Co., St. Louis, Mo., is now with the Federal Bearings Co., Inc., Poughkeepsie, N. Y., as engineer.

JOHN ALDEN ENGLISH is now designing engineer, Warren McArthur Corp., Bantam, Conn., manufacturers of airplane seats and special tubular aluminum furniture.

JOHN S. MALONEY, formerly research engineer, Chandler-Evans Corp., South Meriden, Conn., is now research engineer, Aero Supply Mfg. Co., Inc., Corry, Pa.

J. B. SPRINGFIELD, formerly engineer, South African Airways, Railways & Harbors, Germiston, Transvaal, Union of South Africa, is now service representative, United Aircraft Corp., East Hartford, Conn.

CLYDE L. HEDRICK has been commissioned first lieutenant, U. S. Army, and is stationed at the University of California at Los Angeles. He was formerly head, mechanical arts department, Palm Springs High School, Palm Springs, Calif.

W. D. FOLTZ who was field engineer, Bendix-Westinghouse Automotive Air Brake Co., Pittsburgh, recently has been called to active service in the Quartermaster Corps, U. S. Army.

HARRY DICKSON has been named zone parts and service manager for western Canada, General Motors Products of Canada, Ltd., with headquarters at Regina. He was formerly district service manager.

GEORGE J. MERCER, consulting body engineer, Detroit, is author of a new technical book entitled "Crown Surface Development Problems." The book contains an assembly of surface development problems and is designed to meet the up-to-date requirements of draftsmen in the motor body, aircraft and die and tool designing industries. Mr. Mercer is also author of "Motor Body Engineering Problems," and "Motor Body Blue Print Technology."

Defense Impact on Industry Stressed at 1941 SAE Summer Meeting Sessions

(*Continued from page 29*)

resistance averages 84% of its value for the new tire. Power consumption appears to be affected to only a very slight degree by the differences of texture of the usual hard road surfaces. When such roads are wet, they pointed out, the power consumption is slightly greater, partly because the tires run somewhat cooler.

Early in their presentation, the authors explained that they followed current usage in expressing the drag in rolling resistance in lb per 1000 lb of load on the tire, and that most of the data presented were obtained in the laboratories of the contributing companies by running the tires against pulleys or flywheels. Since it was felt that a consolidation of the data accumulated by various tire companies would furnish comprehensive and authoritative treatment of the subject, they continued, tire engineers from several companies have pooled and averaged their test results in preparing this discussion.

DISCUSSION

Correlation of the authors' test results obtained from tests on laboratory rolls with those run on the road by the Chrysler Corp., was reported in written discussion by W. E. Zierer of that corporation, in prepared discussion read to the session by Paul C. Ackerman, also of Chrysler Corp. In general, the authors' conclusions coincide with our test results, Mr. Zierer asserted, except that, as stated in the paper, values obtained on laboratory rolls are higher than those checked on the road. Questioning the authors' statement that "the power consumption of 15-in. rim tires is from 90 to 95% of that for 16-in. rim tires," he suggested that it would seem that the larger diameter tires would have less deflection and, consequently, less drag.

Mr. Zierer also wondered why the effect of tire construction was not discussed except for the mention of 6-ply versus 4-ply tires and rayon versus cotton cords. Differences in tire design, he contended, are very important from the standpoint of fuel economy. We have tests, he reported, showing 4 to 9% difference in power loss and 3½% difference in economy in tires of the same size, number of plies, and cord material.

Mechanical Minds for Motor Cars – HAROLD E. CHURCHILL, Studebaker Corp.

SLIDING gears will not be used in the final version of a generally satisfactory automatic gear box, Mr. Churchill predicted, concluding his discussion of automatic devices in motor cars in which he placed special emphasis on automatic and semi-automatic clutches, drives, and transmissions. The final design of automatic drive, he specified, must be torque and speed-responsive; it should have at least four gear ratios or their equivalent to provide satisfactory performance. Only a choice of direction, selected from a neutral position, and operation of the accelerator should be required by the motor-car operator, Mr. Churchill declared.

Continuing his prophecies on future trends in transmission design, he opined that the clutch pedal and driver operation of the clutch will soon be eliminated in automobiles in which price consideration permits the installation of automatic transmissions. Elimination of the clutch pedal, he pointed out, will cause public demand and acceptance of power braking, operated by a foot treadle and requiring low pressure and short travel for definite control of the braking system. Kinetic energy of a circulating fluid, in combination with a planetary gearing automatically controlled by mechanical means, Mr. Churchill believes, may provide the best means for producing a satisfactory method of transmitting power from the engine to the driving wheels of an automobile.

Early in his talk, Mr. Churchill pointed out that automatic devices, of necessity, must complicate rather than simplify the mechanism of the car. Trained specialists are required, he said, for the service techniques involved. However, he averred, these problems are more than offset by the convenience and pleasure afforded the driver.

In a review of the merits and demerits of the fluid coupling, Mr. Churchill brought out that it:

1. Reduces shock loads on the driving mechanism.
2. Damps out torsional disturbances in the drive line.
3. Makes possible use of the maximum torque of the engine over a wider and lower range of speeds, thus permitting starting in high gear.

On the minus side, the following difficulties observed on tests of fluid-coupling installations were reported by the speaker:

1. Possible damage to the rear main bearing because of high coupling temperature.
2. Oil fumes entering the interior of the car should the coupling "blow off."
3. Increased temperatures at the toe and floor boards requiring better insulation.
4. Ventilation of the clutch housing and baffling for adequate dirt exclusion.

In addition, he declared, the following objections may be noted by the car owner: increased fuel consumption; higher engine speeds for a given axle ratio; higher towing speeds required to start the car; and inability to move the car with the starter in case of emergency.

DISCUSSION

Walter T. Fishleigh, consulting engineer, the first to discuss Mr. Churchill's paper, revealed that he was torn between two conflicting desires with respect to transmissions. "I am not sure," he confessed, "how far I want to go in having the transmission do the whole job." On the other hand, he concluded, the sooner all cars are provided with automatic transmissions, the better off the average driver will be.

That the driver should still be the supreme authority in any automatic drive was emphasized by Chairman Smith and J. H. Hunt, General Motors Corp.

The "mechanical mind" of the transmission, Mr. Hunt contended, should never be stronger than the driver's. In spite of all that can be done mechanically, he explained, situations will arise when the automatic transmission will overrule the driver. He pointed out that, because they know these mechanisms so well, engineers are likely to object to certain features of automatic transmissions that the public accepts readily. One desirable feature, he said, is that an automatic transmission will shift gears without releasing the torque, especially on the up shift. He pointed out that such a transmission would shift gears faster than the type that requires momentary torque release to effect the shifts. Discussing fluid torque converters, Mr. Hunt contended that their overall efficiency should be at least as good as that of geared transmissions.

"If people like what you have to offer in a fluid type of drive so much that 85 to 90% of car buyers order it even though it does cost extra in gasoline," contributed H. T. Woolson, Chrysler Corp., "it must mean something." Steps are being taken, he reported, to cut down the gasoline consumption of this drive. He expressed his belief

Golf Chairman

Harold O. Johnson

that semi-automatic control that permits the driver to do what he wants when he wants is to be preferred over the fully automatic control.

Both Mr. Woolson and Mr. Fishleigh expressed agreement with Mr. Churchill's conclusion that the clutch pedal is on the way out.

***Designing for Alternate Materials* – THOMAS A. BISSELL, technical editor, SAE Journal (This paper is published in full in the Transactions Section of this issue)**

WHEN aluminum, zinc, nickel, tin, chromium and other critical or strategic materials become unavailable for passenger car use, alternate materials can and will be substituted without lowering standards of safety, durability, performance or comfort, Mr. Bissell concluded, following a part-by-part analysis of what substitutions already are possible and what further developments seem likely. But, Mr. Bissell emphasized, the substitution program means higher costs in practically every instance.

Stressing the remarkable ingenuity and skill with which automobile engineers are finding means to utilize alternate materials in place of those most urgently needed for national defense, Mr. Bissell pointed out, however, that there are certain basic materials for which satisfactory alternates cannot be worked out. On the list of irreplaceables, he named steel, copper, rubber, lead, some kind of upholstery material and, possibly, glass.

Development of substitutes for aluminum already has gone far, Mr. Bissell showed, outlining among other examples, the series of design changes necessary in substituting cast-iron for aluminum pistons and describing some of the problems met in making those changes. The chief obstacle in one design, he explained, was in attempting to cast the dome of a dome-type piston in iron without machining and to hold its profile to as close limits as when die-cast in aluminum. This particular problem, he said, was worked out by developments in foundry technique – thus illustrating the length of the string of problems involved.

Recent widespread adoption of thin-babbitt bearings with longer fatigue life has minimized the problem of changing from cast-iron to aluminum pistons, he stated.

Selecting an alternate material for brake wheel pistons of extruded high-grade aluminum alloy has been a knotty problem, Mr. Bissell said, mentioning one company which tried powdered metal, cast iron, screw-machine steel, welded steel forgings and special glass before satisfactory results finally were achieved and approval obtained on a low-grade aluminum casting.

Changes looking toward elimination of nickel in passenger cars, according to Mr. Bissell, consists of "substituting non-nickel steel alloys for those of nickel; replacing other nickel alloys used in miscellaneous parts; taking out the nickel used in certain cast irons; eliminating or reducing the amount of nickel used in chrome plating; and dispensing with such plating entirely."

Although preliminary figures indicate that about 50% of the zinc formerly used in automobiles will be absent from the 1942 models, engineers have been studying substitutes for the literally hundreds of die castings scattered through the modern car in preparation for a possible complete shut-off of zinc supplies, Mr. Bissell reported. According to recent estimates, many passenger-car engineers are prepared to take out more than 80% of the former zinc weight. One company estimates, however, that items such as carburetors and fuel pumps made from cast iron will cost 25% more on an emergency basis than those of zinc alloy because of the greater tooling and machining cost.

After describing numerous examples of how alternate designs are being developed to eliminate Neoprene, tin, chromium, rubber, magnesium, manganese, antimony, tungsten, leather and cork, Mr. Bissell concluded that "although adopted through necessity, there are indications that some of the alternate parts will stay permanently." They will have had time during the emergency to prove their worth, he said, and their cost will have been lowered through design and production development. "This is one of the brightest spots in the picture," Mr. Bissell said, "since the exigencies of the emergency will force many developments that would not have been made under normal conditions."

Mr. Bissell's paper was developed and written under the auspices of the SAE Passenger-Car Activity Committee.

DISCUSSION

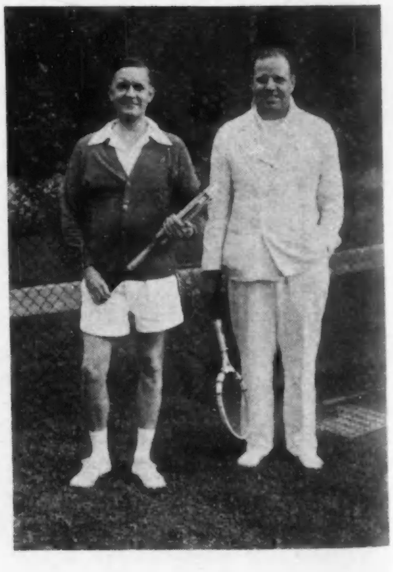
Quick corroboration of Mr. Bissell's conclusion that substitution of alternate materials so far has necessitated no lowering of quality came from Joseph Geschelin, Chilton Co., and Chairman Smith. To support his point Mr. Smith reported that tests on engines carrying cast-iron alternate pistons showed performance superior to that obtained with the regular aluminum-alloy piston assemblies in one instance.

Encouraging news as to present and future supplies of nickel, Neoprene, and zinc was brought to the session by representatives of suppliers of these critical materials.

Pointing to a nickel production four times that in World War I and three times that of 1929, T. H. Wickenden, International Nickel Co., assured that greatly increased demand alone is responsible for the present nickel shortage. Even so, he added, there should be enough nickel for both defense and civilian purposes if demand were spread out evenly over the entire year. The trouble is, he explained, that some companies with "A" priority ratings have ordered far ahead.

Tennis Players

Graham Edgar
and
Sydney G. Tilden



Furthermore, he continued, there are now only two countries getting nickel – Great Britain and the United States – the exports formerly made to the rest of the world have been stopped.

The 1.2 lb of nickel in the steel of the average 1940 automobile, he revealed, has now been reduced to about ¼ lb. Since valve manufacturers have offered to reduce the nickel in exhaust valves to 1½%, he continued, this figure will be reduced further to about 0.15 lb.

Acute shortages are developing in practically all steel alloying materials, he reported, mentioning chromium particularly, supplies of which from Greece and Turkey recently have been cut off.

"We really have quite a nickel mine in the steel scrap produced in the aircraft industry," he revealed, pointing out that 75% of the steel supplied to the aircraft industry is reduced to scrap. He reported that plans are being made to segregate the different types of nickel-steel scrap so that a maximum amount can be recovered. The steel scrap loss in the automobile industry is only 25 to 30%, Mr. Wickenden declared, replying to a question by Norman G. Shidle, SAE Journal. Explaining the larger percentage of scrap in the aircraft industry, he pointed out that large scrap losses occur in forging, bar ends, and flashing, and in the much greater machining loss caused by the necessity to reduce weights to a minimum. Finished aircraft cylinders weigh only one-fifteenth as much as the raw material originally furnished, he brought out.

A large amount of nickel is going into defense parts where its use is not essential, Mr. Wickenden reported in reply to a question by Mr. Hunt. He cited as an example that food trays made out of 18-8 corrosion-resistant steel were being ordered by the millions. The problem, he explained, is that, once defense specifications are written, it is difficult to get them changed. He expressed his belief that considerable nickel could be saved if defense specifications were analyzed and nickel eliminated wherever the service did not require a steel of high hardness combined with toughness.

Production figures on Neoprene, quoted by F. L. Yerzley, E. I. du Pont de Nemours & Co., Inc., also brought encouragement to passenger-car engineers. Last November, he recalled, production was doubled, bringing it up to 1,000,000 lb per month. By next October, he continued, when a new plant unit gets into operation, production will reach 1,650,000 lb per month. Some time next year when a new plant is completed in Louisville, he predicted, production should climb to 40,000,000 lb per year. This amount, Mr. Yerzley believes, should be able to satisfy all possible requirements.

Word from Washington that the OPM has no intention of handicapping the automobile industry by requiring substitutions that impair efficiency of operation or entail excessive costs, was relayed to the session by C. R. Maxon, New Jersey Zinc Co. During 1942, he predicted, from 75 to 80% of the zinc normally used will be available for civilian use. He urged passenger-car engineers to consider each application of zinc on its own basis, classifying those that are essential and those that are dispensable.

To J. E. Hale, Firestone Tire & Rubber Co., who brought up the difficulty of getting zinc oxide for use in rubber compounds, Mr. Maxon suggested that he get in touch with John A. Church of the OPM, Social Security Bldg., Washington, D. C. Austin Wolf, automotive consultant, contributed that the paint manufacturers have had to work out alternates for zinc-base paints for use in marking roads. He expressed his endorsement of any basic design in which a pleasing effect is obtained by simplicity, substituting "brains for material."

That the automobile industry is almost 70% self-supporting in sheet steel because of scrap reclaim was brought out by Mr. Geschelin. Referring to plastics, he pointed out that the plastics industry is being goaded into attempting more than it has the capacity to produce by engineers seeking alternate parts of plastics.

The Motor Car Rides with Plastic – GEORGE W. WALKER, Industrial Designer.

PROJECTING his ideas to the day "when technical problems are licked and mass production is really under way" on plastics for automobile body use, Mr. Walker spoke enthusiastically of the opportunities offered the designer and of the advantages which may accrue to car owners.

Certain colors can be inherent parts of the body and painting operations can be eliminated, he said. Transparent plastics substituted for glass can be molded to flow in with the body lines of the car, he pointed out, and heralded the coming of a transparent roof for automobiles which would give passengers visibility as great as when a convertible's top is down. "Right now," he emphasized, "we are taking our cue from aircraft builders and are working with designs of pleasingly curved windshields and windows of plastics."

Tomorrow's car may have roofs of translucent as well as transparent and opaque plastics, he went on. "Already off our rendering boards are designs which pleasingly incorporate all three forms – individually and in combination.

"I confidently believe the day of the plastic car is almost here," Mr. Walker stated, but qualified by defining such a car as one in which half the body's weight will be due to steel used as a superstructure, plastic panels being fastened to this steel framework.

War conditions will hasten the adoption of plastics for additional automobile parts, Mr. Walker believes, urging that curtailment of important materials can be turned into a blessing by automobile men.

Recounting the wide variety of uses to which plastics are being put today in many fields, Mr. Walker concluded that "plastics have already completely demonstrated that they are logical materials to incorporate to a far greater degree in automobiles."

Following Mr. Walker's talk, an interesting motion picture, "The Magic of Modern Plastics," was presented through the courtesy of *Modern Plastics* magazine.

DISCUSSION

Answering specific questions, Mr. Walker brought out several new points and re-emphasized others during the brief discussion.

Transparent plastics will scratch, he admitted, but pointed to the unscratched plastic top of an experimental car which already has been in hard service for 7 months as proof of the possibility of satisfactory performance of plastics for this purpose. Scratches can be polished out when they do appear, he claimed.

Explaining the production method used to fabricate the translucent plastic gun turret which he had brought to exhibit to the meeting, Mr. Walker expressed the belief that dies for automobile tops, while they would cost tremendous sums, would probably be only a little more costly than those necessary for steel tops.

Lighter weight, elimination of painting operations, and greater quietness were some of the plastic body advantages listed by Mr. Walker in response to the blunt question: "When you do get a plastic body – what have you got anyhow?"

Plastics are affected by cold and heat, Mr. Walker confirmed, but believed that this difficulty can be overcome by use of expansion joints. The first extensive use of plastics in car bodies, he suggested, might be in developing transparent plastic tops.

TRANSPORTATION AND MAINTENANCE SESSIONS

Chairmen

E. P. Gohn **A. M. Wolf**

Transportation and maintenance engineers heard two unusually provocative papers, pace setters for future reports of the present T & M Activity project. Mr. Lautzenhiser described "Motor-Vehicle Load Distribution Factors," offering the audience a simple method of calculating load distribution for trucks, semi- and full-trailers. J. Willard Lord presented an objective study of "Design Elements Affecting Safety." Both papers stimulated discussions of significance.

Load Distribution Factors – F. B. LAUTZENHISER, International Harvester Co.

ANALYZING motor vehicle load distribution, Mr. Lautzenhiser found that the five major factors involved were maximum tonnage, best possible speed, continuous operation, safety, and lowest cost per unit transported. The paper was the first preliminary report of the Transportation & Maintenance Activity's program, and is expected to be the basis of the recommendations of Subcommittee D-5, in the charge of E. P. Gohn, Atlantic Refining Co., chairman of the session.

Scheduling is the basis of speed, the author contended, and each type of operation dictates scheduling. The degree of continuous operation depends almost entirely upon adequate preventive maintenance; expensive as are truck tie-ups in repair shops, delayed deliveries with the ensuing loss of confidence in the company by customers and possible rental of other equipment to make deliveries is a source of excessive costs. Putting safety on a dollar-and-cents basis, the author called attention to the fact that "one bad accident may cost more than a whole fleet of good trucks." He decried the yardstick of "cost per mile" traveled, contending that the only adequate measure is one that shows the cost of delivery of a cubic yard of material, per ton, or per case or package.

Hence, Mr. Lautzenhiser concluded, a careful time study of operation must be made, considering the nature of the goods transported, its weight, bulk, and the quantity carried, whether on the basis of per trip per hour, per hour, or otherwise. It is also important to determine the frequency of trips to arrive at the required cycle of operation. This time study is essential in studying the type of equipment, size of the body, and other factors before purchasing trucks.

Best possible speed can be predetermined only by studying the street congestion, highways and hills to be climbed, number of starts and stops which will be required in average operation, and time lost in loading and unloading. Then a survey of state laws and city traffic regulations is needed to determine if laws will be complied with in the proposed operation. Only by such a study can the operator determine whether the proposed operation will be profitable.

An important contribution made by Mr. Lautzenhiser was a series of charts showing simple methods of calculating load distribution on four-wheel trucks, six-wheel trucks, tractors, or semi-trailers. The important dimension, he contended, was the distance the load center or concentration point was located *ahead* of the truck or tractor rear axle. For a correct gross weight distribution on a given wheelbase, the load center should be located at the same point whether the vehicle is a straight truck or a tractor. He found, he reported, that the new SAE standard cab-to-axle dimensions bear a definite relation to body lengths for the conventional type of front end design truck, regardless of some small variations in the front axle location, etc.

Because the fifth wheel of a trailer combination is, in effect, equal to the load center, it should be located at the same point on the chassis as would be the center of a truck body. Both from the standpoint of equalizing the weight between the front and rear axles of the tractor unit, and to incorporate the greatest factor of safety in respect to jack-knifing and providing sufficient weight for steering and front-wheel braking, the fifth wheel should be located ahead of the rear axle. He detailed the calculation process for determining the optimum location of the fifth wheel.

He presented claims for an adjustable fifth-wheel to fit changing operating conditions that certain trucks must meet. The author suggested the use of trailers designed with a rounded forward end to move the load center of the trailer further forward.

DISCUSSION

Austin M. Wolf, automotive consultant, believed Mr. Lautzenhiser made a very thorough analysis of the subject of load distribution, which was one of the fundamental factors in attaining reliable and economical transportation through the proper inter-relation and cooperation of the various units in the vehicle structure which are affected.

One subject not discussed, Mr. Wolf pointed out, was that of the diminishing load, as in the case of tankers. The driver must follow instructions on the sequence of emptying compartments. Most operators have worked this out methodically, and while perfection is not possible, the distribution is sufficiently accurate to come within the permissible variation in the loading.

"I feel that dual front wheels are in the offing," continued Mr. Wolf, "and, of course, in such an event, many of our present concepts will be altered due to the new potentialities."

All the cases presented in the paper were based on static load distribution, he pointed out. "I wish to call attention to dynamic load distribution. With the speed possibilities of present trucks and buses and their braking capacities, the added load increment affecting the front suspension, braking, and tires must be given equal thought to those phases covered in the paper. In many cases these units may be severely overloaded. Naturally the height of the center of gravity of the spring mass should be kept as low as possible. To me the dynamic phase is equally, or possibly, more important than the static."

The nature of the load – whether solid or liquid – also affects dynamic distribution, he said. Swash plates minimize the effect.

On the point of an adjustable fifth-wheel, Merrill C. Horine, Mack Mfg. Corp., pointed out that such devices give the driver an additional thing to do. He suggested that a single control could be worked out by shifting the position of the king pin. Because of limitations imposed by the throat clearance of semi-trailers, it was often impossible to secure adequate king pin offset.

T. C. Smith, American Telephone & Telegraph Co., endorsed the idea of locating the fifth wheel ahead of the rear axle, especially for heavily-laden light trailers. Safety both in braking and steering would be thus incorporated, he believed. He feared the use of an adjustable fifth-wheel because operators might not adjust the load far enough ahead of the rear axle to insure safety.

L. R. Buckendale, Timken-Detroit Axle Co., cited the practice of some Pacific Coast operators who remove the front brakes altogether in their semi-trailer operations. He feels, that especially in going down grade, careful attention should be given to proper weight distribution, and pointed out that, when operating down hill on a sleet- or ice-covered road, a minimum of braking should be employed to avoid skidding.

B. B. Bachman, Autocar Co., sketched a method of calculating load distribution in particular reference to down-grade operation. He agreed that the topic was of great importance to insure safety of operation.

Charles G. Morgan, Jr., American Trucking Associations, pointed out that at certain state lines a vehicle must be changed from a full- to a semi-trailer. "This plays hell with brake efficiency and safety, anyway you figure it," he commented.

Dean A. Fales, Massachusetts Institute of Technology, declared that Mr. Lautzenhiser's paper was an outstanding

contribution to the knowledge of the problem of load distribution, congratulated the T & M Activity, and said he will use the paper as a text in his courses.

Design Elements Affecting Safety – J. WILLARD LORD, Atlantic Refining Co.

IN one of the most objective papers presented before the Society, J. Willard Lord, Atlantic Refining Co., described the design elements in motor vehicles affecting safety, submitted as a preliminary report of Subcommittee D-7 of the Transportation & Maintenance Activity's program. As pointed out by B. B. Bachman, Autocar Co., the specified requirements did not attempt to tell *how* safety features should be achieved, but gave a summary of *what* motor-vehicle operators wanted in respect to safety.

Mr. Lord pointed out that safety was not a thing apart from design, but was integral therewith. "Safety and efficient operation go hand in hand. Today, when both equipment and trained drivers are at a premium, industry cannot afford the luxury of losses resulting from needless accidents," he said.

"A truck can be a beautiful piece of engineering, and may withstand severe tests in actual use, but if it is the very devil to drive, fatiguing to operate, difficult to maintain, disliked by drivers and mechanics, it will have a high incidence of accidents."

Cab visibility is too often overlooked by truck designers, he said. Some cab roofs are so low in their relation to the driver's seat that tall men are obliged to hunch over to look out. Wide or flaring pillar posts reduce visibility, and narrow and small cabs hamper maneuvering.

Studies of accident causes disclosed that drivers became exhausted and went to sleep while driving. Talking with individual drivers showed that certain types of vehicles were far less fatiguing to drive than others. Hours behind the wheel is not a yardstick, but the ease of steering, comfortable seats, light pedal pressures, good ventilation, adequate visibility and other factors of personal comfort have as much to do with fatigue as has time, he found.

The author detailed cab design and suggested control over violent pitching of the cab, particularly in cab-over-engine vehicles. He suggested big shock absorbers on cabs.

Truck cabs should be better ventilated against engine fumes and heat, and suggested pressure ventilation in rain and snow to prevent fogging of the windshield. Heaters should be provided for winter driving, he said, because despite the notion that a warm cab makes a driver drowsy, a comfortable man will do a better job of driving than will a man who is half frozen.

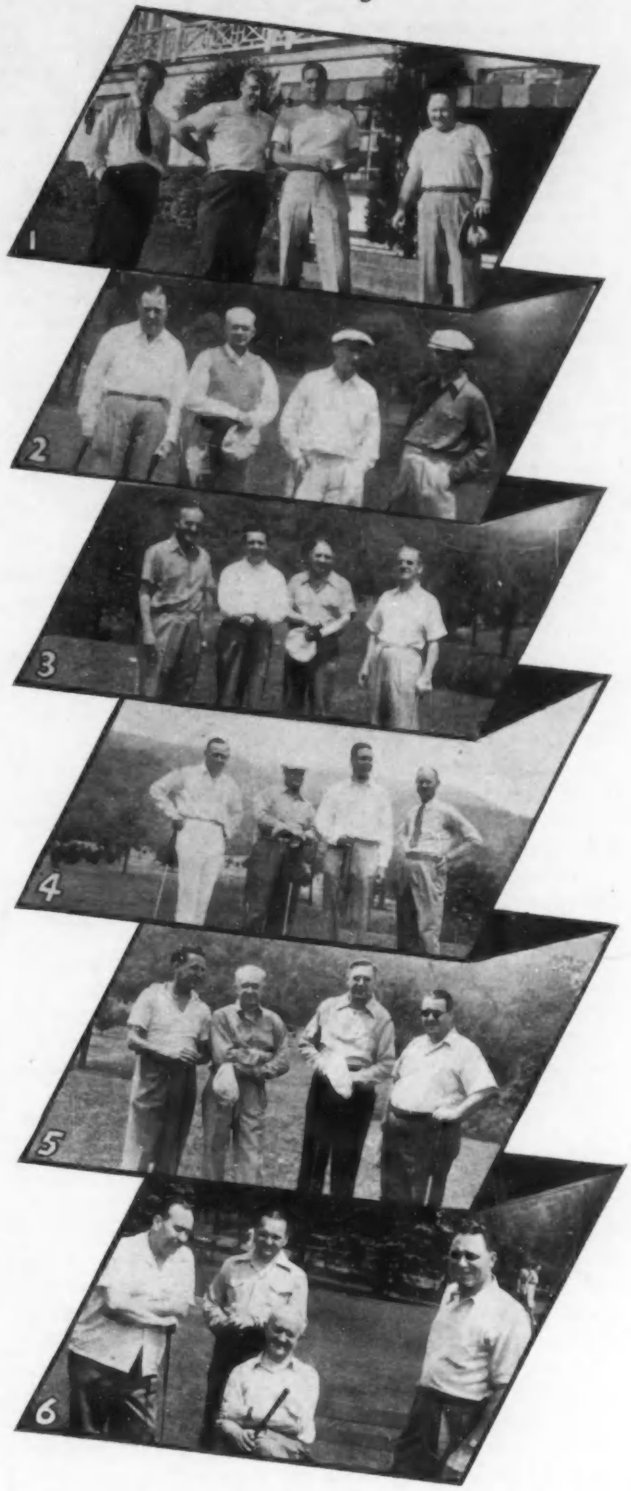
His own company has attached light-weight Morton treads to cab steps and running boards to make climbing in and out less hazardous.

As a result of a careful study of mirrors, the author found that a plain mirror on the left and a convex one on the right works well. He suggested that designers, used to driving automobiles and with little or no experience with driving trucks, could not realize the burden imposed upon truck drivers who could not see through the rear window, as in a car.

Mr. Lord suggested a standard arrangement of controls. Particularly, he said, relief drivers have trouble in locating controls because they drive several makes of vehicles. He believed that there should be a standard arrangement of controls, as follows: clutch, brake, and accelerator. With the perception of phenomenon of a scientist he found that floor boards show a regular groove worn into the boards by the edge of the driver's shoe indicating that an accelerator improperly placed forced the drivers into an uncomfortable and cramped position. Correlating this with the fact of a number of accidents against stationary objects within the company's property, resulting in explanations saying that drivers' feet got twisted, indicates the need for some standardization in control arrangement. Rubber-faced pedal pads tend to become slippery when oily. With Neoprene on the restricted list of the OPM, he suggested the simple device of stamping or forging a lip on the pedal to prevent slippage off the pedal. Hand brake levers should be standardized. Some are difficult to reach, and others requiring pulling the lever up – an established reason for runaway trucks. All, he reported, should be easy to reach.

The speaker believed that the sealed-beam headlight should be incorporated into truck design. Stop lights should have a 21 cp output, and should be 5 or 6 in. in diameter instead of 3 in., as is common practice. He believes too few trucks are equipped with adequate fog lamps. These should have a clear glass lens, and mounted low – about 20 in. from the ground. They should be connected through a separate fuse for safety. Many clearance lights are so installed as to be in such a position as to shine into the rear vision mirror and thus mislead the driver. These could be mounted higher. Directional signal switches should be mounted under the steering wheel for left-hand operation. These switches should move from left to right, instead of forward and backward – the latter is a safety hazard because of itself, is no indication of direction, he pointed out.

Golf Gangs



1 – Ralph R. Clarkson, Whiting N. Shepard, Gordon Brown, and Harry M. Bramberry
2 – Lyman P. McIntosh, Charles W. McKinley, J. H. McDuffee, and J. W. Fleischer
3 – Earl Cosgrave, S. Clifford Merrill, Raymond E. Carlson, and Horace Davies
4 – Sandford Brown, Frank Sharpe, Gordon Brown, and Robert F. Steeneck
5 – F. C. Crawford, C. W. McKinley, A. T. Colwell, and John A. C. Warner
6 – C. G. Morgan, Jr., J. H. Kurlander, Fred C. Horner, and A. Vance Howe

Inadequate size of lamp wire, and poor insulation and weak terminals, have caused fires on trucks, a problem of grave importance to gasoline transportation vehicles.

The report showed that lack of standardization of bumper heights is an important factor in safe operation of trucks. The author suggested mounting auxiliary car bumpers at the rear, and that the front bumper should protect the front bumper step. From 10 to 20% of all accidents reported by many fleets are the result of backing accidents where automobiles have run into the back of trucks without this protection.

Reducing the fire hazard in case of accidents should be approached from a design standpoint, providing heavy gasoline tanks and protection, and adequate fire extinguishers. Fatalities in connection with fire accidents as compared with non-fire accidents are in the ratio of three to one.

His careful analysis of brakes resulted in concluding that truck brakes should be of the reaction type for smooth application, and extreme care should be exercised to see that they are in balance. This is particularly important when the tractor unit is purchased from one manufacturer and the trailer from another, he said. Hand brakes should be adequate to hold the unit when power take-off is in operation, and chock blocks should not be necessary. He called upon operators to require the best possible attention to brake maintenance.

DISCUSSION

Vice-President Preble, Tide Water Associated Oil Co., led off the discussion by calling attention to the fact that although human life throughout the world is again at the dime-a-dozen level, the Society is continuing to investigate the accident-prone vehicle in order to realize the goal of a greater degree of highway safety.

M. C. Horine, Mack Mfg. Corp., agreed that although the turn signal offered the best warning when it was directional, experience has shown him that about half of the truck drivers on the highways forget to turn the signal off, or switch it on too long before the contemplated turn. He is in favor of flash type of signals.

Commenting upon the author's hope that the sealed-beam headlamp would become standard for trucks and buses, B. B. Bachman felt that this alone would not solve the problem of the glare hazard. A basic idea of the sealed beam headlight system, he pointed out, was that the driver remembers to use the traffic beam – which most don't. Certainly, he said, when the sealed-beam lamps become used on trucks and buses, the drivers must be taught to use them properly or any prospective advantage would be lost. "For many years we have been talking about designers getting better acquainted with the problems of the motor-vehicle operators, but now the T & M Activity is doing something about it. If this is a sample of the reports we can expect, we are going to go a long way in a short time."

T. C. Smith felt that cab design has left a great deal of room for improvement. The arrangements, equipment, and general design appear to be the result of a hazy after-thought, and he favors consideration of the cab as an integral design problem of the truck itself. Seating comfort, he held, was a direct safety factor.

F. B. Lautzenhiser disapproved of signal devices which indicated the direction of the contemplated turn. He was in favor of a flash type of signal, however.

John L. S. Snead, Jr., Consolidated Freightways, Inc., who got in from Portland, Ore., just in time to hear Mr. Lord's paper, presented a dismal picture of the torture to which drivers were subjected by bad cab design. Seats always hit the driver at the wrong places along his spine, brake levers are difficult to reach, pedals don't hold the shoe edge and sometimes are badly placed, visibility is bad, and instruments often are hard to see. Adjustable seats would be a boon, but he felt that this alone would not suffice. He startled the audience by declaring that there is no need of front-wheel brakes in his operation over the icy mountainous highways along the Pacific Coast. To keep front wheels from becoming sled runners, he takes the brakes off altogether.

Charles G. Morgan, Jr., believed that much could be done for safety through driver comfort by improved seating arrangements and using adjustable bucket-type seats. Ventilation is important, but he has seen no improvement in this respect. However, he pointed out that perhaps the difficulty was that about 90% of trucks are sold for short-haul service, hence there had been no careful engineering of cab designs.

"I have heard more honest-to-goodness truth at this meeting than at any I can recall," Lee Oldfield, Schwitzer-Cummins Co., said. He praised fleet operators for their successful driver training programs, but felt that courtesy should be continually stressed. "It's pretty hard to remember to be courteous when you have been sitting for hours in an uncomfortable cab seat," he remarked.

B. Frank Jones, White Motor Co., agreeing that too little thought had been given to visibility, suggested use of transparent plastics for windows.

DIESEL-ENGINE SESSIONS

Chairmen

G. C. Wilson **Harte Cooke**

Diesel-Engine Sessions, bearing on important problems in defense production and concentrating on methods of increasing power through supercharging, brought a volume of to-the-point discussion limited only by the time available.

During the opening-session discussion, emphasis was placed on the necessity of consulting experts in new applications of materials and new production methods. The importance of designing from the ground up for the material or production method was stressed.

At the opening of the second Diesel-Engine Session, attention centered on methods of supercharging, with papers on mechanical supercharging and the Buchi Turbo-Charging System. A third paper dealt with correlating data on compression-ignition engine performance at different intake and exhaust conditions.

***Fundamentals of Welding Applied to Steel Crankcases* – EVERETT CHAPMAN, Lukens Steel Co.**

WITHOUT eulogizing the advantages of welded steel construction, except to remark "it is wonderful," Mr. Chapman told of the basic troubles with welding. He described many of the common welding faults, emphasized the need of complete fusion, and with photo-elastic studies – both stills and movies – he compared stresses developed around perfect and defective welds.

Some welding defects, he said, can be traced back to the drafting room and, he added, the designer should realize that things can be done with the pencil that can't be done with a welding arc. He also pointed out that standards for "T" welds often call for measurement of "throat distance" whereas merely adding metal does not necessarily make a thing stronger. Proper sculpturing of a weld is more important.

"There is too much tendency toward welding anything," he commented in calling attention to the importance of metallurgy. With some alloys, he said, the cold metal around the weld extracts heat from the area surrounding it and has a quenching effect, thus creating a hardened zone near the weld. The result, he said, is that cracks appear in the material near the weld. The answer, he advised, is to preheat so that the quenching action is not so rapid. The accepted tempering heat, he reported is 1200 F.

Mr. Chapman told how thermal residual stresses are produced and may be avoided. He also described welding processes that serve to eliminate common welding errors.

In commenting on lateral rigidity, Mr. Chapman showed how a small per cent of added metal judiciously placed, considerably reduces lateral deflection.

DISCUSSION

First called upon for discussion was William B. Stout, Stout Engineering Laboratories, who remarked that whether we like it or not we must adopt new engineering methods and materials. The result, he feels, is that we will build better engines at less cost. Mr. Stout later pointed out that the cost of a good weld is less than for a borderline job – in that lighter metal well welded would have strength equal to heavier metal with an inferior weld.

Ralph Boyer, Cooper-Bessemer Corp., said that, while his company has had little experience with welded-steel construction, they have found that its chief advantage is its shock-resistance quality. In frames, he said, welding has shown little saving over cast iron in weight and the cost is greater than aluminum. However, he added, this may be corrected. Aluminum frames, he said, weigh about 38% of cast-iron frames and, although they cost 60¢ per lb compared with 6¢ per lb for cast iron, the overall cost is about four times as great.

Joseph Geschelin, Chilton Co., entered the discussion to ask Mr. Chapman about progress in economies of welded steel construction. This brought the reply that the surface has hardly been scratched. There have been some economies introduced and more are coming. Costs may eventually be one-tenth as cheap as they are now. Mr. Chapman emphasized, however, that current effort is toward getting weight down and toward welding thin sections. Progress in this direction is indicated by the use of welded steel structures in aircraft.

A. W. Pope, Jr., Waukesha Motor Co., asked about all main joints being chipped from the back and filled in, a method advocated by Mr. Chapman. The latter explained that it is necessary to design for this type of weld, and that the chipping is best done by a pneumatic hammer. A gas torch may be used, he said, but will not be successful if non-oxidizable drips are encountered.

Mr. Chapman spoke of welding as the answer to the foundryman's problems in that if a part is too large to economically cast in one piece, it can be cast in two or more pieces and be welded together.

When John J. Hilt, Young Radiator Co., remarked that the human element is an important factor in welded steel construction, Mr. Chapman stated that his experience has indicated that if variables in materials are tied down, the human element will be a minimum consideration.

Aluminum Alloy Applications for Major Diesel Engine Parts – PHILIP B. JACKSON, Castings Division, Aluminum Co. of America

ALUMINUM has major contributions to make to modern diesel engine design, Mr. Jackson contended, giving many specific examples to illuminate his thesis. Sufficient stiffness is obtainable with aluminum, he said, considerable weight reduction can be achieved through its use, and stress distribution of a high order can be obtained without presenting unusual foundry problems.

He pointed out also that water jacketed aluminum castings are practical and that aluminum castings, properly designed, are entirely suitable for use where high impact loads are anticipated. Moreover, fabricating facilities are available for the manufacture of reliable aluminum castings in an exceedingly wide range of sizes, Mr. Jackson said.

With equal standards of design, Mr. Jackson stated, it is practical to make an aluminum engine structure which will weigh not more than half that of cast iron – no compromises of any nature need be made. Design and development in welding practice, however, may bring engine bases of steel and cast aluminum somewhat nearer in weight, Mr. Jackson admitted.

Discussing the design of crankcase and engine bases, Mr. Jackson urged that "rigidity in excess of operating requirements is valueless" and outlined certain relationships which are essential to satisfactory design. "The modulus of elasticity of aluminum is only 1/3 that of steel and 15 to 40% less than that of cast iron," he explained, continuing: "Because rigidity of a given section is a direct function of the modulus of elasticity, designs using aluminum must have increased dimensions. Rather small increases in dimensions of a section in aluminum provide a rigidity factor equal to that of cast iron or steel sections of similar form."

Bolts, Mr. Jackson said, unquestionably are the most simple form of fastening aluminum assemblies, but, he pointed out, screwing studs directly into aluminum is standard practice and is entirely feasible. Any trouble with studs, he emphasized, is caused by poor design or failure to follow sound established practices. Stud stresses in excess of 30,000 psi are used in the aircraft industry, he stated.

Years of satisfactory service, Mr. Jackson concluded, justify the practice of using aluminum for liquid-cooled engines. Some failures of aluminum parts that have been attributed to corrosion were actually electrolysis or erosion. Heavy oxide coatings, impregnated with a corrosion inhibitor are effective in inhibiting erosion under severe operating conditions, he stated, adding that electrolysis may be prevented by electrically insulating the dissimilar metals from the aluminum.

DISCUSSION

Discussion of Mr. Jackson's paper started with prepared comments by F. M. Young, Young Radiator Co., who pointed out: "The presence of conditions in the flow of hot liquids or hot gases with impingements on surfaces

SPORTS

A VARIETY of sports events brought widespread participation and keen competition throughout the week.

SAE President A. T. Colwell won the Men's Golf Championship, becoming the first president of the Society ever to achieve that honor, either during or after his term of office. Mr. Colwell had previously won the Championship in 1936. Runner-up was C. W. McKinley, who had won the championship at Lake Saranac in 1934. Flight winners were: "A" flight, B. W. Elgin; "B" flight, W. W. Cromley; and "C" flight, R. L. Miller.

Mrs. J. K. Anthony won the Women's Golf Championship and Mrs. H. A. Davies was runner-up.

A closely contested skeet-shooting event resulted in J. A. Gelzer being crowned champion, and E. W. Griffith, runner-up.

Field Day sports brought first prize for men to Clarence Bruce, and second prize to Charles Hollerith, Jr. First prize for women went to Mrs. E. F. Rossman, and second prize to Mrs. E. F. Riesing.

Ladies' bridge winners for the week were: Monday, Mrs. F. W. Sampson; Tuesday, Mrs. C. W. Georgi; Wednesday, Mrs. C. H. Baxley; Thursday, Mrs. W. G. Ainsley.

and flowing in a manner to release to a given point a volume of materials for vicious attacks on metal through having badly shaped ports and surfaces in coursing the liquids or hot gases through surfaces often creates corrosion possibilities and enters into great troubles where under so-called ordinary conditions with easy flow without impingement and with separation of the vicious gases to that material, this would not occur. That is why in one engine, corrosion is not experienced, and in another it is."

Mr. Young took issue with the author's statement regarding limited corrosion of aluminum alloys in the presence of hot sea water and gave examples from automotive experience where trouble has been encountered due to the presence of high chlorides in cooling water. "We would naturally expect," he said, "the installation of a marine engine with circulating sea water being used as a coolant to have the aluminum parts seriously affected by corrosion."

Conceding that corrosion is a controversial topic, Mr. Jackson remarked that corrosive action varies under different conditions.

In marine operation, he stated, the maintenance problem is relieved by fresh-water cooling systems. However, he added, the installation of this system is not brought about because of corrosion of aluminum, but by other engine requirements. The salt-water cooled marine engines mentioned in his paper, he revealed, are in Coast Guard Service. To a comment by Mr. Young that thin water-jacket walls are subject to attack, Mr. Jackson said that Mr. Young had in mind water-jacket walls of the through-bolt type, whereas those of the non-through-bolt design are heavier and give added protection against failure.

H. L. Knudsen, Cummins Engine Co., stated that he was glad that Mr. Jackson placed emphasis on the low modulus of elasticity of aluminum – a property not often enough considered. Where over-all stiffness is wanted, he said, there are cases where the stiffness of an individual part can be overdone. To this, Mr. Jackson added that rigidity in excess of operating requirements is of little value.

Problems and Possibilities of Mechanical Supercharging of Diesel Engines – H. L. KNUDSEN, Cummins Diesel Engine Co.

THE most serious problem arising from higher degrees of supercharging is the increase in exhaust temperatures and the amount of additional heat to be handled. This conclusion was expressed by Mr. Knudsen following a theoretical exploration into the possibilities of supercharging and the ultimate limit to which it is possible to go. He also made prediction as to the efficiencies which may be expected with increasing degrees of supercharging, with and without compressor intercooling.

Mr. Knudsen discussed some of the present-day superchargers, including the Roots, vane, centrifugal, and exhaust-turbo type blowers, and listed the advantages and disadvantages of each.

Before closing his paper, Mr. Knudsen emphasized the need for more compact and efficient accessories. No attempt has been made, he said, to improve the specific capacity of these units, with the result that, as we go down in engine size and up in horsepower, the auxiliaries become larger, heavier and bulkier than ever – so much so that, at the present time, we are almost to the point where the engine proper is completely hidden behind an assorted number of clumsy and unwieldy accessories.

DISCUSSION

When called upon for discussion, C. G. A. Rosen, Caterpillar Tractor Co., commented: "Mr. Knudsen has shown the advantages to the diesel in burning more air – there is still, however, much reason to expect improvements in the blower. The thermal degeneration of an engine is always a vital practical factor. It is of marked influence in maintenance costs. The temperature of air charged to the cylinders from the blower bears an important relation to power output, peak pressures and exhaust temperatures, all of which determine engine life.

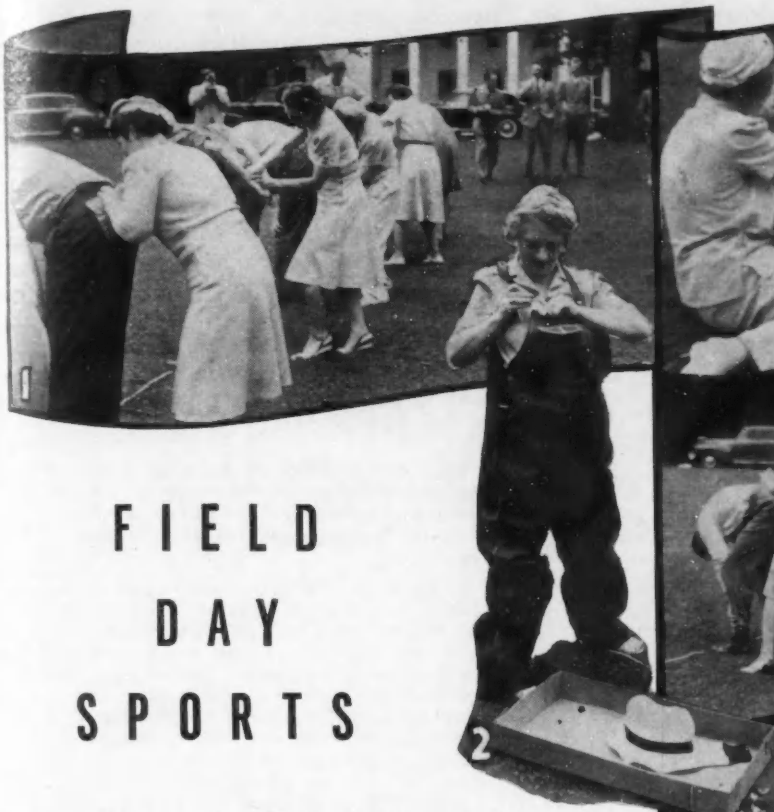
"An undesirable factor in blower design for variable-load mobile equipment," Mr. Rosen continued, "is the necessity for designing the blower to satisfy conditions at the peak of the torque curve rather than at full load full speed." He pointed out that, to realize the theoretical advantages of supercharging, the blower must be better and cheaper.

John L. Ryde, McCulloch Engineering Corp., in written discussion read by F. M. Young, Young Radiator Co., commented that Mr. Knudsen's choice of the Roots-type blower closely parallels his company's analysis. It was decided, he said, that the Roots-type blower is the simplest unit mechanically, even when comparing it with the centrifugal blower; that the precision required in its manufacture is well within the limits of up-to-date high-production machine tool equipment, resulting in lower original cost; and, this type of compressor presents a very fertile field for development.

"Our present research activities," he said, "are directed towards higher rotative speeds and, of particular importance, higher efficiencies." He pointed out that the efficiency of the supercharger has a very marked effect on the performance of the engine and that this stands out very clearly on some of the present marine engines where the maximum output is of greatest importance. On this type of engine, he said, a small variation in the efficiency of the supercharger results in a markedly greater change in the engine output.

Mr. Ryde agreed with the author that one of the greatest disadvantages of the Roots blower is the loss through slip or air leaking back through the clearances, resulting in low volumetric efficiency. He said: "The volumetric efficiency is a linear factor in the overall efficiency of the unit. In order to reduce the slip, we have developed units with sealed end clearances showing a considerable improvement in efficiency. Similar to the gear pump, the end or axial clearances of the rotors have a great influence on the slip, and by closing these to substantially zero, the efficiency is increased materially. Likewise," he continued, "a further gain was made by coating the rotors with a special plastic compound to reduce the rotor-to-rotor clearance without incurring trouble due to scoring or interference. This permitted the retention of satisfactory manufacturing tolerances necessary for production without a sacrifice of performance."

"The author's choice of the positive-displacement blower over the centrifugal type from considerations of reliability, sensitivity, and efficiency appears at variance with our experience in the aircraft-engine manufacturing field," was the introductory statement of Kenneth Campbell, Wright Aeronautical Corp., in discussion of Mr. Knudsen's paper. He pointed out that the Roots-type blower was the first type used for aircraft-engine supercharging in this country, being applied to one of the older Whirlwind models years ago. "Difficulty was experienced," he said, "from wear due to uneven expansion or from the wide clearances which this necessitated, and the centrifugal compressor was chosen in the search for a more reliable type. These centrifugal units operate up to tip speeds of 1250 fps for high-altitude work, a typical design



FIELD DAY SPORTS

incorporating an 11-in. impeller rotating at 26,000 rpm maximum. This gives a pressure ratio of over 2.5:1 with a clearance between the stationary shroud and the open side of the impeller from 0.035 to 0.045 in. Practically no mechanical difficulties are ever encountered with these blowers."

With regard to the sensitivity of the centrifugal blower, Mr. Campbell stated: "When the impeller is geared to the crankshaft, neither speed nor throttling (at the inlet) nor density change with altitude, shift the operating point on the Q/N characteristic curves except in small degree. Exhaust back-pressure variation, by slightly varying the volume and resulting power, can cause a small shift along the characteristic curve; but, here again, only if the supercharger is wrongly proportioned for the engine and the operating point is located away from the non-critical or relatively flat region of the efficiency curve, should this shift cause any appreciable effect on the manifold pressure developed. It is true," he added, "that, when variable supercharger gear ratio is provided with a given design and engine speed, this shift becomes greater and must be considered in the design of the supercharger." He reported that published adiabatic efficiencies of centrifugal-type superchargers for aircraft engines are approximately 70%.

When asked by Dr. U. B. Bray, research consultant, if the centrifugal supercharger can stand the gaff of truck operation, Mr. Campbell replied that indications are that it could. Mr. Knudsen pointed out that a poor installation job by the customer might result in excessive back pressure and reduced delivery.

In answer to a question by Prof. G. C. Wilson, University of Wisconsin, Mr. Knudsen stated that the power to drive the blower is included in data on frictional horsepower.

Chairman Cooke announced that J. P. Stewart, who was to present the second paper, had been grounded in Pittsburgh by the weather, and that Ralph Boyer, another of the co-authors, would make the presentation. It turned out that Mr. Stewart had the slides with him, so Mr. Boyer was compelled to refer to figures as presented in the mimeographed copies of the paper rather than on the screen.

***American Experience with the Buchi Turbo-Charging System* – J. P. STEWART, Elliott Co.; RALPH BOYER, The Cooper-Bessemer Corp., and JOHN W. ANDERSON, American Locomotive Co. (Presented by Mr. Boyer)**

BRIEFLY reviewing the background of the Buchi system in the United States, the authors commented that although the American diesel-engine industry has lagged somewhat behind the European developments, it is more than making up for lost time. Particular reference was made to the pioneering activities of its most active sponsors in this country, the Cooper-Bessemer Corp. and the American Locomotive Co.

Harking back to the original European tests of the Buchi system and ensuing development until it reached the state of practicability and general acceptance, the authors remarked: "This evolution is now a matter of history, but the most important single factor involved discarding the constant-turbine-pressure idea for the present method of creating timed pressure pulsations in the exhaust pipes. This provided a means of efficient scavenging with low air pressure and made possible increases in output with lower charging pressures than would be possible otherwise. The development was accompanied also by numerous refinements in the details of engine design, as well as centrifugal blower and high-temperature engine design."

Broad design considerations were discussed concerning the requirements for best results with the use of this type of supercharger. Performance curves covering several makes of engines were shown on the screen, and characteristics of the turbo-charged engine explained. Special attention was given to turbo-charger units of American manufacture.

One interesting revelation made by the authors was the result of tests showing that the turbo-charged engine would carry suddenly-applied full load in the same manner as an unturbo-charged engine, and that the size of the flywheel could be decreased materially over an unsupercharged engine for sudden-loading requirements.

Of interest to operators was the report that American Locomotive Co. experience has been that no additional maintenance difficulties or costs are involved with Buchi turbo-charged engines rated up to 50% above the unsupercharged output of the same engine. In fact, it was stated, the turbo-charged engine is found to be in better condition during the routine maintenance experience than the unsupercharged engine.

Looking ahead, the authors predicted that the 4-cycle supercharged diesel engine is on the verge of rapid evolution toward a substantial reduction in specific weight and space, to be accomplished by considerable research and field operating experience.

DISCUSSION

"In my opinion, the turbo-charger is a greater step forward than the diesel engine itself," was the comment of R. Tom Sawyer, American Locomotive Co. "I make this statement," he said, "because the turbo-charged diesel has both maximum economy and maximum performance. We have proved that in the locomotive field."

Slamming box cars around with a diesel locomotive is certainly harder service on a supercharger than placing it in a truck in any kind of service, was Mr. Sawyer's basis for his comment that the turbo-charger will stand up mechanically in the automotive field.

He pointed out that all high-powered diesel locomotives in Europe are equipped with turbo-chargers and that there are several hundred 600-hp turbo-charged diesel railcars in use. Special comment was made of the German 4-cycle 600-hp railcar Maybach engine weighing 10 lb per bhp, the lightest engine in the service, and the next lightest, the Junkers 2-cycle engine weighing 11 lb per bhp. Another discusser gave later figures showing the Maybach engine now weighs less than 8 lb per bhp.

Mr. Sawyer, in referring to maintenance costs of 137 660-hp diesel locomotives not supercharged, and of 58 locomotives with the same engine turbo-charged to 1000 hp, said that, in taking the age of the locomotives into consideration, he could find no appreciable difference in maintenance.

H. L. Knudsen, Cummins Engine Co., voiced agreement with the authors' comments but concerning application of the turbo-charger to trucks, remarked that the mechanically driven supercharger is superior for variable speeds and rapidly fluctuating loads. With the turbo-charger, he said, rapid pickup is accompanied by smoke, indicating overload conditions.

Others entering the discussion were Prof. L. C. Lichty, Yale University, and F. Glen Shoemaker, Detroit Diesel Engine Division, General Motors Corp.

***A Rational Basis for Correlating Data on Compression-Ignition Engine Performance at Different Intake and Exhaust Conditions* – MARTIN A. ELLIOTT, Explosives Division, Bureau of Mines**

A study of published data on the performance of compression-ignition engines at a variety of operating conditions, Mr. Elliott said, has shown that the relation of indicated efficiency to fuel-air ratio is a fundamental correlation of great assistance in analyzing, interpreting and generalizing test results. This and other basic relations, he stated, have been used in deriving rational equations for correcting to standard ambient conditions the performance of compression-ignition engines operated at a constant speed and throttle setting. Comparison of the power-output ratios computed from the rational equations with corresponding ratios determined experimentally, he explained, show satisfactory agreement throughout a wide range of ambient conditions.

Mr. Elliott presented empirical methods for correlating data on volumetric efficiency and on friction mean effective pressure at different ambient conditions. Certain of these methods, he opined, may be of theoretical interest and should receive further consideration.

After a brief discussion of formulas for representing the effect of air density on the power output of spark-ignition engines equipped with carburetors, Mr. Elliott stated that a comparison of these relations with those for compression-ignition engines shows that the same relations cannot be applied to both types of engine. This, he explained, is because at a constant speed and throttle setting, fuel-air ratio, and consequently indicated efficiency of a compression-ignition engine, is affected by ambient conditions, whereas these factors are not affected in the gasoline engine, provided the carburetor maintains a substantially constant fuel-air ratio.

Mr. Elliott commented that his study was made in connection with those undertaken by the Bureau of Mines of hazards that might attend the use of diesel engines underground. In the Bureau studies, he said, consideration was given to the possible effects of changes in temperature and pressure of intake air on the quantity of harmful and objectionable gases produced by such engines.

DISCUSSION

Prof. J. S. Doolittle, The Pennsylvania State College, in prepared discussion read by P. B. Jackson, Aluminum Co. of America, gave data to support his contention that the method presented by Mr. Elliott is not applicable for correlating performance of 2-cycle engines and that care must be taken before applying it to 4-cycle engines to make sure that the air-fuel ratio affects the indicated thermal efficiency of the actual engine in the same manner that it does in the ideal engine. "In other words," he said, "this method of handling the effect of variations in inlet and exhaust pressures on diesel-engine performance is not a final solution of the problem but does aid in approaching a final solution as it gives means of predicting the performance of certain types of engines.

"The first part of this paper is a worth-while experimental confirmation of the straight-line relationship between indicated efficiency and fuel-air ratio in the prac

tical region. In the second part of the paper the author missed the point." This was the opinion expressed in prepared discussion by Prof. P. H. Schweitzer, The Pennsylvania State College, read by Mr. Rosen.

"When correcting the power output of a compression-ignition engine to standard ambient conditions," Prof. Schweitzer stated, "the interesting point is not how much the engine develops at altitude or at various intake air pressures and temperatures on the basis of *constant throttle setting*. The interesting point is how much power the engine develops in altitude, and so on, irrespective of throttle setting."

After pointing out that in the diesel engine maximum power is not associated with any fixed throttle setting, Prof. Schweitzer asked: "If fixed control position cannot serve as a basis of comparison between sea level and altitude performance or between standard and non-standard ambient conditions, what can be used as a basis?" He answered, "the same as for rating diesel engines under standard conditions; the basis should be smoke and knock." He then went on to explain how this basis can be applied.

The final discussion of Mr. Elliott's paper was prepared by O. D. Treiber, Diesel Division, Hercules Motors Corp., also read by Mr. Rosen. Mr. Treiber asked the author to clarify a number of specific points and suggested changes in several equations. He remarked that the paper indicates that variations which exhaust vibrations can make with respect to engine breathing may have been overlooked. These, he commented, can be serious and change with speed, load, exhaust-pipe length, size, and other factors to act as accelerators and retarders of breathing, depending on the combination of variables.

In connection with the indicated thermal efficiency ratio to fuel-air ratio, Mr. Trieber said, it must be kept in mind that fuel-injection systems vary with different makes of engines and that the amount of fuel burned at constant volume and the rate at which it is burned thereafter affects the expansion ratio and therefore the thermal efficiency. Furthermore, he continued, with reduced fuel-air ratios the amount and rate may both change, or the latter only, and these can affect the thermal efficiency favorably as expansion ratios are increased by reducing the latter end of the injection.

Mr. Treiber also emphasized the importance of giving more study to fuel-air ratio in engine development and testing and also exhaust-gas analysis especially oxygen and CO content. "When we know more about what comes out of the exhaust," he said, "we can better guide our actions in what and how we put in and get into the cylinders through spray nozzles and intake valves."

FUELS & LUBRICANTS SESSIONS

Chairmen

C. G. A. Rosen — **J. R. Sabina**

A thoroughgoing summary and interpretation of CFR fuel tests on full-scale diesel engines, and an up-to-the-minute review of data obtained from road tests conducted at high speed and high atmospheric temperatures, were presented at the first Fuels and Lubricants Session. In discussion following three knock-rating papers at a second session, the distributor was attacked and defended as the cause of unduly high octane requirements. One method of simulating road tests in the laboratory, explained in a fourth paper, was compared with apparatus developed in several other laboratories.

Evaluation of Diesel Fuels in Full Scale Engines – Report of the Cooperative Fuel Research Committee – Presented by W. G. AINSLEY, Sinclair Refining Co.

IN summarizing the data from the full scale diesel engine tests now in process, Mr. Ainsley pointed out that fuel characteristics are related, and, though engine performance varies with the test values on the fuels used, it may or may not be a direct relation. Conclusions drawn from the comprehensive laboratory and field tests are: (a) the ignition quality of the fuel (cetane number ASTM) affects starting, engine smoothness, exhaust smoke, exhaust odor and combustion chamber deposits; (b) the volatility of the fuel (ASTM Distillation) affects smoke and engine deposits; (c) the viscosity (Saybolt Seconds) affects smoothness and smoke – also a decrease in viscosity causes a decrease in power; (d) the gravity (API) affects smoke, power and fuel consumption; (e) the carbon residue on 10% bottoms (ASTM) affects smoke and combustion chamber deposits.

In view of the need for a universal diesel fuel suitable for mobile Army and certain high-speed Navy equipment, Mr. Ainsley reported, the data and advice available to the Automotive Diesel Fuels Division of the Cooperative Fuel Research Committee have been analyzed and are offered as an aid in the development of the specification for such a fuel. The speaker presented a résumé of a series of discussions of the more important fuel variables by the cooperating members based on information available from the cooperative full scale engine tests, laboratory data and field experience. These discussions covered the following physical characteristics of the fuel; viscosity, volatility, flash point, carbon residue, ignition quality, pour point, ash, water and sediment, sulfur and corrosion.

The first half of the progress report was devoted to the history of the Automotive Diesel Fuels Division of the CFR Committee, the cooperative work of 16 engine companies, refining companies and associated groups participating in the full scale projects and the test procedures of the various laboratories engaged in "determining the properties of analyses which influence engine performance and engine deposits."

DISCUSSION

First to comment on the CFR Committee report was Almon L. Beall, Wright Aeronautical Corp., who stated that, while he realizes the paper is a report, he feels that the data deserve broader treatment than given in the analysis. The volatility part of the work, he added, did not receive the emphasis that he would be inclined to give it.

G. H. Cloud, Standard Oil Development Co., in written discussion presented by A. J. Blackwood, of the same company, commented: "The results of the cooperative tests are interesting in that they have shown several diesel fuel characteristics to have a marked influence on engine performance, and we agree with the principal conclusion that insufficient data are available as yet to permit of definitely answering many of the questions that might arise regarding separate effects of the various fuel properties. However, we are of the opinion that a somewhat different treatment of the test data will permit a clearer differentiation between the effects of these characteristics than has been given in the report."

After explaining, with slides, the steps taken, he stated: "In summing up, selection of the test data so as to eliminate unnecessary and complicating factors permits the following conclusions: Engine roughness, deposits and smoke increase almost linearly with decrease in cetane number, and smoke and deposits increase linearly with 50% point and almost linearly with viscosity. None of the data indicates that, on the basis of the average results, there is a limit to either cetane number, viscosity or 50% point at which an abrupt change in engine performance can be noted."

Comments on the report by O. D. Treiber, Hercules Motors Corp., were briefed by Charles Becker, Tide Water Associated Oil Co. Mr. Treiber noted that the consideration of the Committee was of the ASTM D-2 fuel specification, and suggested that, for automotive diesel fuels, the D-1 specification should be considered. He expressed his thought that this fuel should be satisfactory for all mobile equipment from the slowest to the highest-speed diesel engines. He also commented that the four reference fuel specifications have API gravity ranging from 26.6 to 40.8. "It seems," he said, "that 26.6 is a little high to include satisfactory West Coast fuels or fuels with predominant naphthenic composition."

Mr. Treiber argued that lubricating oils must be considered with any deposit tests on fuel oils and comparisons made on exactly the same oils, temperatures and engines, and that the lube oils for these tests should not have additives to destroy, absorb, or dissolve deposits from fuel oil.

Commenting further on deposits, Mr. Treiber said: "I do not believe that gravity, viscosity, ignition quality, volatility or distillation limitations will have a true or direct relation to deposits. I believe that it is the oxidized hydrocarbon molecules in the fuel or those molecules which will not evaporate or burn by the "burn-out test" which cause the trouble. Some means of determining and measuring the quantity of these offenders is, in my opinion, the crux of the specification control of deposits from fuel oil."

Continuing, Mr. Treiber discussed fuel characteristics which affect smoke and cold-starting, and the importance of gravity and flash and pour points in diesel fuel specifications.

L. E. Hebl, Shell Oil Co., urged the industry to avoid the conclusion that the work is completed on the evaluation of diesel fuels. Much more remains to be done, he said, and further analysis might reveal relationships not yet determined.

Quoting experiences with his company's engines, F. Glen Shoemaker, Detroit Diesel Engine Division, General Motors Corp., revealed these relationships: engine deposits decrease as volatility of the fuel is increased, and deposits decrease as cetane number is increased.

Review of Temperatures Road Test Engines – B. E. SIBLEY and H. C. BALDWIN, Continental Oil Co. (Presented by Mr. Sibley)

RESULTS of road fleet tests at high speed and high atmospheric temperatures were presented by Messrs. Sibley and Baldwin. Temperatures of engine and oil as well as under-hood and carburetor-bowl temperatures recorded during the tests were reviewed. Engine-stand temperatures under controlled conditions were compared with operating conditions, as encountered, under the severe conditions of the road activity. The road tests reveal, they stated, that, despite the higher engine speed, load, and atmospheric temperatures, the oil temperatures recorded during the road tests were lower than those recorded during controlled-temperature engine laboratory tests.

They commented that, while fleet-test engines were in agreement with laboratory engines in rating the oils used, results with the road-test engines showed more difference between certain oils than indicated by the engine laboratory tests. In general, they added, the oils were rated less favorably by the test-fleet engines.

The authors also gave figures comparing high-speed road-test oil temperature readings of passenger-car and heavily-loaded truck engines. The oil temperatures were shown to be less severe in the truck engines, which, they said, raises the question as to which should use the "heavy-duty" type of oil. They contended that the operations of heavy-duty units are of greater duration and at a higher output of their rating when compared with passenger cars, hence the demand upon the lubricant is more severe. Also, that more of the engine heat is transferred to the radiators of heavy-duty units and, therefore, does not heat the oil to extreme temperatures. Attention was directed to the importance of design effectives in decreasing maximum oil temperatures.

Figures on the rate and amount of tire wear, collected during the test runs, along with the estimated miles to a smooth tread condition, were also revealed by the authors.

DISCUSSION

Starting discussion of the Sibley-Baldwin paper, discussion prepared by Max M. Roensch, Chrysler Corp., was presented by Alfred G. Marshall, Shell Oil Co., Inc. Agreeing with the authors that the importance of low oil temperature cannot be overestimated, Mr. Roensch stated that one of the important factors in oil temperature, not brought out, is the effect of axle ratio on oil temperature at given car speeds. If a car is geared to have excellent hill performance, he said, it is very likely that high crankcase temperature will be encountered at high car speeds due to the fact that engine speeds are high. However, with overdrives, underdrives, and automatic transmissions, the engine speeds will be reduced at high touring speeds, which will, in turn, result in much lower crankcase temperature.

In general, Mr. Roensch said, the temperatures submitted in the paper seem to be on the low side compared with experience of his company with the same cars. "We are at a loss to explain the low oil header temperatures of the cars in Group B," he continued, "because we can see no logical reason for a drop of 36 F in the oil temperature between the oil sump and the distribution side of the oil pump in the oil gallery. Our experience has been on these same three popular cars that there is only a 3 or 4 F difference between the oil temperature as measured in the oil pan at the gage-stick point and the temperature in the oil header feeding to the main bearings."

Another factor stressed as important by Mr. Roensch, is that the heat flow into the oil at 70 mph road load is considerably less than running at top speed and, he added, if data have been presented showing the oil temperatures at the maximum car speeds, the tests would indicate that the laboratory tests now being used, with an oil sump temperature of 290 F, are not too far out of line with what is to be expected under severe conditions on the road.

In prepared discussion, H. C. Mougey, General Motors Research Corp., commented: "If in our attempts to make accelerated oil tests, the test conditions are so far from actual service that the oils are being incorrectly evaluated, then the accelerated test conditions should be modified to enable us to secure better correlation."

Mr. Mougey pointed out that lowering oil temperatures, under some conditions, may make things worse instead of better. He said, further, that, while heat may be removed by water cooling, oil cooling, air cooling or by general radiation, he does not believe that anyone has shown that removal of heat by any one of these methods is fundamentally capable of producing higher engine efficiencies than by any other. However, he added, the very important observation he believes should be drawn from Mr. Sibley's discussion is that any unnecessary cooling which is done simply to take care of an oil which is not sufficiently resistant to the effects of elevated temperature may actually cause an appreciable loss in efficiency. The only real solution, he said, is the development and use of oils which are superior in their resistance to oxidation at high temperatures.

The work of cooling of the engine as done by the oil was discussed by Joseph A. Moller, Pure Oil Co. He pointed out that the amount of cooling which water, for

a given set of conditions, can be counted on to do is rather definite; whereas the amount of cooling which oil can be depended upon to accomplish, in addition to its function of lubrication, for a given set of conditions, is still quite empirical and depends to some degree upon the oil and engine condition desired. Improved engine design and practice are surely a goodly portion of the solution of oil-cooling problems as it has been in those arising in water cooling, he said. However, he added, unlike the water-cooling situation, the oils themselves can be improved. First, he said, the critical temperature values for given operating conditions can be improved, and secondly, in so far as engine condition and operation are concerned, the penalty for exceeding to a reasonable degree the present, or elevated, critical operating temperature values for given operating conditions, can be reduced to a minimum.

Dr. U. B. Bray, research consultant, warned that in making accelerated laboratory oil tests, too great a departure in temperature from conditions actually met in service may give misleading conclusions.

The fact that the one truck engine reported on by Mr. Sibley shows lower oil temperatures than the passenger-car engines, in passenger-car service, led Dr. Bray to ask whether this truck engine was a passenger-car engine converted to truck service or an engine designed from the ground up for truck service. Mr. Sibley answered that the latter was the case.

G. L. Neely, Standard Oil Co. of Calif., remarked that effort should be made to keep the crankcase temperature down. Higher temperatures, he said, have virtue above certain engine levels, in the combustion-chamber zone, but not in the crankcase.

Recounting similar experiences as noted by the author in that lacquering conditions are encountered on the road and not found in dynamometer tests, although the dynamometer temperatures are higher, C. C. Moore, Union Oil Co. of Calif., stated that, by developing a laboratory cycle of operating 1 hr at low temperature and 2 hr at high temperature, he obtained results similar to road tests.

A. Ludlow Clayden, Sun Oil Co., said that, when withdrawing samples on a dynamometer test for analysis, results depend upon how long the sample stands before analysis.

On reducing under-hood and engine-block temperature, Mr. Clayden declared that there is a strong desire by engine and gasoline producers to do this so that the volatility of gasoline and thus the octane number can be increased.

Mr. Sibley explained that the test fleets operated only about 9 hr on the road test and then shut down for the night and stops were made for fueling. This, he said, might bear out Mr. Moore's findings. However, Mr. Sibley stated, his belief is that the more rapid deterioration of oil on road tests is its greater duration of exposure to oxygen. Mr. Sibley also noted, in connection with Mr. Moller's remarks, that "we always have used oil as a coolant and will continue to do so, but it shouldn't be depended upon too much as a coolant or it will become overloaded."

1940 Road Detonation Tests – J. M. CAMPBELL, General Motors Research Division, R. J. GREENSHIELDS, Shell Oil Co., and W. M. HOLADAY, Socony-Vacuum Oil Co. (Presented by Mr. Greenshields)

This report was printed in full in the May, 1941, SAE Journal, Transactions Section, pp. 193-204.

The Significance of the 1940 CFR Centralized Road-Test Technique to the Engine Builder – W. E. DRINKARD, Chrysler Corp.

THE relatively new road-test procedure for studying the detonation characteristics of fuels in automotive engines developed during the 1940 CFR Centralized Road-Test Program provides three principal benefits to the engine builder, Mr. Drinkard concluded in summarizing his paper:

1. The detonation characteristics of fuels in automotive engines have been clarified.

2. A useful research tool for engine development has been made available.

3. Definite promise of obtaining more significant specific information about commercial motor fuels is indicated.

The Borderline Knock Spark Advance technique already has shown that much of the existing confusion on this subject has resulted from past test methods and thus has indicated a course to be followed in future work that holds a definite promise of progress, Mr. Drinkard pointed out.

In former efforts it must have been considered imperative to obtain a single rating for a fuel or a car, he explained and, in order to obtain a single rating, a most important variable – engine speed – was disregarded. This variable is so important, he emphasized, that single ratings obtained by its elimination often were confusing and misleading to the engine builder. The validity of evaluating a fuel or an engine by a single number is no better than would be the evaluating of the volume of a non-cubical box by the length of one side, he declared. All the specific procedures investigated at the Centralized Cooperative Road-Test Program treated engine speed as an important variable, he reported.

Mr. Drinkard explained that the automotive engine builder can apply this technique readily to two problems confronting him in the process of development:

1. Influence of general engine design on detonation.

2. Determination of distributor spark-advance characteristics for an otherwise developed engine.

The Ignition System as Influenced by Fuel Characteristics – J. T. FITZSIMMONS, Delco-Remy Division, General Motors Corp.

IGNITION timing can be used as an accurate indicator of the detonation characteristics of a fuel over the entire speed range of the automotive multicylinder engine, Mr. Fitzsimmons announced, reporting the results of recent tests.

Present engines, he explained, usually require the spark to be set below the point of maximum power to avoid objectionable detonation, and a more advanced spark timing with a higher octane fuel will give more power where desired.

Unfortunately, he pointed out, the spark-advance requirements with change of speed are not uniform on various commercial fuels from different sources with different processing and blending. Unless a very high octane fuel is used, the automatic spark advance on the distributor supplied on the engine may not be equally satisfactory on different fuels.

There seems to be no easy or practical way, Mr. Fitzsimmons believes, to make possible the adjustment of the ignition timing by the driver to accommodate different fuels now used. It does not seem desirable at present, from an economic point of view, he opined, to increase the accuracy of the ignition distributor if there is much additional cost involved. When fuels become more nearly standardized as to detonation, he concluded, it may be worth while not only to improve the accuracy of the distributor but also to change the method by which it is driven by the engine.

In his conclusion, Mr. Fitzsimmons offered the following suggestions:

1. Do not hope for a distributor which can be adjusted accurately for various fuels for, even were this possible, the average driver would not know when it was adjusted properly.

2. Develop the automatic advance curve for each engine which will be a compromise such as to give operation without objectionable detonation where this point is below maximum power, for the poorest fuel which may be used.

3. Specify a distributor with close tolerances where necessary and allow them to widen out where not important.

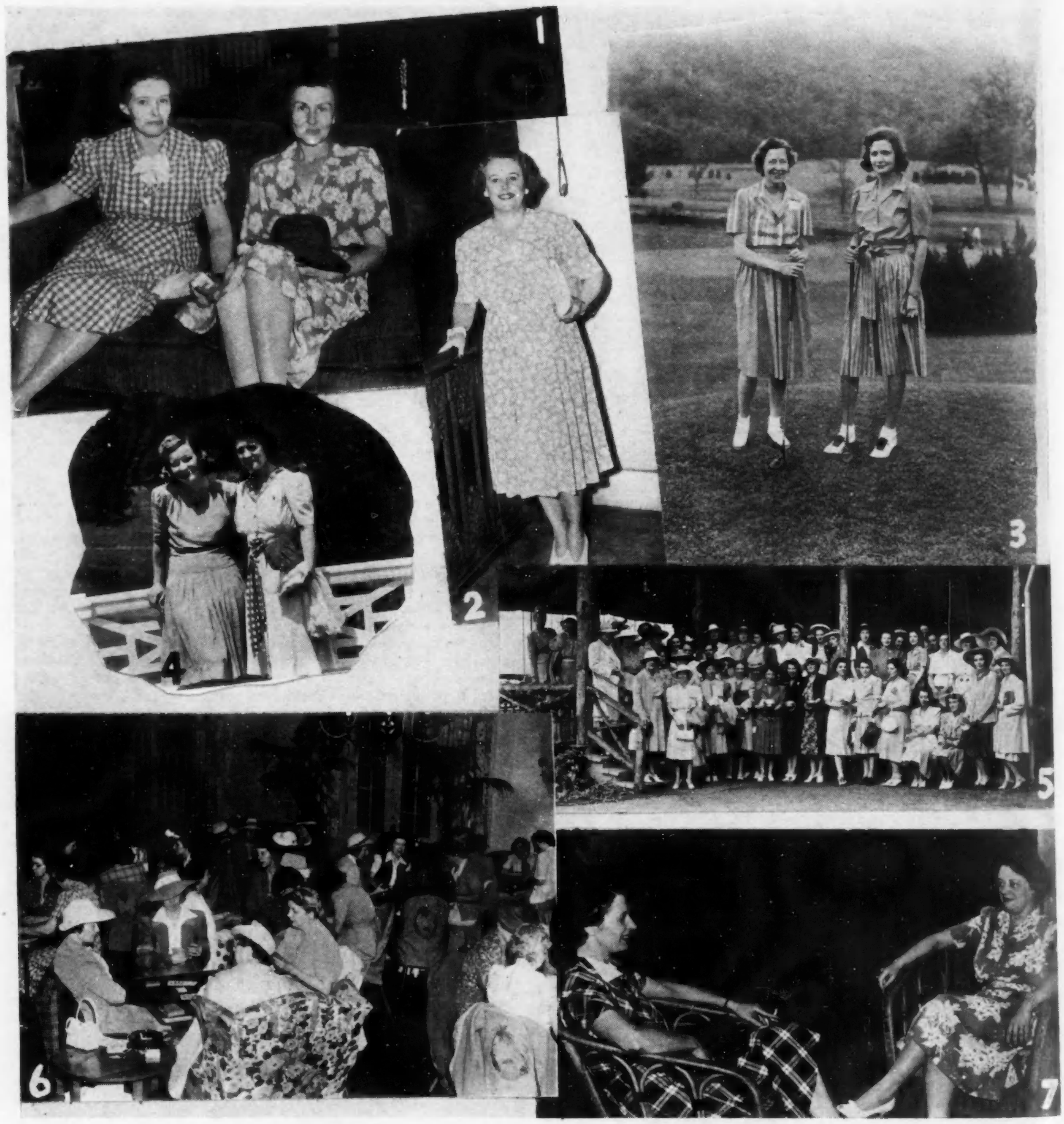
4. Select the automatic advance curve for satisfactory performance rather than for peak power.

DISCUSSION

Fresh data on the effectiveness of various amounts of tetraethyl lead in improving the knock rating of highly paraffinic gasoline, highly olefinic gasoline, and a blend

made up of 50% each of these two gasolines, were presented by W. H. Hubner, Ethyl Gasoline Corp., the first to rise in discussion. Illustrating his exposition with colored slides showing borderline knock curves obtained on a very high compression engine (8½:1 compression ratio), he pointed out that highly paraffinic fuels do not have as good knock characteristics at low engine speeds as do highly olefinic type fuels, and that the tetraethyl lead does a better job at speeds around 1000 rpm in improving knock ratings of a fuel blended from 50% highly paraffinic and 50% highly olefinic gasolines than it does on either of its two components.

A chart correlating laboratory knock ratings with the 1940 San Bernardino road tests was the essence of the prepared discussion of G. M. Wheeler, Tide Water Associated Oil Co., read to the session by C. F. Becker of the same company. This chart shows the relationship for speeds of 750, 1000, 1500, 2000, 2500, and 3000 rpm, respectively, and is based on the average rating of each fuel in all cars. By means of a table comparing estimated



1 – Mrs. Almon L. Beall and Mrs. A. T. Von Schmid

2 – Mrs. Paul H. Oberreutter, Bridge Chairman

3 – Mrs. A. T. Colwell, chairman, and Mrs. F. C. Crawford, member, Ladies' Golf Tournament Committee

4 – Mrs. D. G. Lingle and Mrs. Harold Nutt

5 – At Kate's Mountain House

6 – Ladies' Bridge

7 – Mrs. Edwin F. Rossman and Mrs. F. W. Sampson

borderline octane data with actual test data as determined on 23 fuels in 24 cars at San Bernardino, Mr. Wheeler showed that the ratings are "in excellent agreement." The only fuels which consistently appear to deviate from actual ratings, he pointed out, are the highly aromatic or olefinic types.

That the degree of severity of engine operation has "a profound effect on the octane rating of a fuel in an engine," was the contention of G. L. Neely, Standard Oil Co. of Calif. There is considerable evidence, he continued, to show that this factor can raise the octane rating by from 9 to 25 numbers. A significant result of the San Bernardino road detonation tests, he explained, is that speed was recognized as an important factor. In considering the reason for this effect on speed, he emphasized, more consideration should be given to the temperature level of the combustion chamber, engine deposits, and severity of operation in general. He predicted that this severity factor will prove the chief obstacle in future road-test work and will dictate the direction of study.

In urging engineers "to go through the engine from one end to the other and take out all factors that are penalizing us on octane requirements," Dr. U. B. Bray, consultant, placed particular emphasis on spark timing and the distributor. "It is obvious today," he charged, "that the distributor is a very poorly made instrument." As little as 3 deg tolerance in the distributor, he contended, makes a difference of 8 to 10 octane numbers in requirement. Dr. Bray's report that he had changed distributors four times on his own car because of inaccuracies brought an opinion from Mr. Fitzsimmons in rebuttal that Dr. Bray must have a "distributor complex." Numerous tests have shown, Mr. Fitzsimmons reported, that distributors which have been run 40,000 miles are still within 3 deg of synchronism. Dr. Bray also was answered by Mr. Drinkard who contended that a "distributor that will advance on a fixed line would not eliminate all knock complaints." Other variables, he believes, would still cause trouble.

A. J. Blackwood, Standard Oil Development Co., indicated that Dr. Bray's figures on the effect of spark advance on octane number were high, reporting that the variation was about 1 octane number per deg spark advance. He also brought out that variations of between 5 and 6 deg in spark timing among cylinders still existed.

The suggestion that knock could be controlled by changing valve timing instead of by retarding the spark was advanced by Neil MacCoull, The Texas Co. He pointed out that, by this method, efficiency would be lost at low speeds and gained at high speeds.

A Proposed Method for Duplicating Road Octane Ratings on Multicylinder Engines in the Laboratory – JOSEPH A. MOLLER, H. L. MOIR, F. C. MINOR, and R. R. PROCTOR, Pure Oil Co. (Presented by Mr. Moller)

ALTHOUGH road testing of fuels is unquestionably the most desirable method to use in rating fuels, these authors pointed out, many laboratories are located so that climatic conditions prevent road testing for all but a few months of the year. Since neither the production of engines nor the blending of fuels can "wait on a long period of inclement weather," they explained, "it would be highly desirable if the laboratories of both industries could, at all times, evaluate their products by some device which would duplicate road-test data."

The authors then proposed such a method, describing procedures and apparatus. The development of a reference-fuel framework using multicylinder engines in the laboratory was then recounted, and the method of evaluating fuels in the laboratory, as they are on the road, using "borderline" procedure was explained.

The apparatus itself, they pointed out, consists simply of an oversize dynamometer having a carefully, yet flexibly, controlled field excitation current so that loading can be applied as desired.

It is believed that, from the data presented, the authors concluded, the fact that a "borderline" reference-fuel framework with a good spread has been obtained, and that fuels have been evaluated properly in relation to this pattern, would justify the assumption that unknown fuels could be rated and expected to fall in their proper place on the reference-fuel pattern. It should be understood clearly, they qualified, that this type of laboratory correlation cannot and should not replace road testing, but should be looked upon simply as an adjunct to road testing, useful in predicting fuel behavior on the road. The agreement which has been obtained between road tests and dynamometer results using CFR, API, and other fuels, as illustrated by the graphs and data shown, they contended, is sufficiently close to warrant further and perhaps cooperative study.

DISCUSSION

Discussion brought out that a number of other methods for obtaining road knock ratings in the laboratory were under development or in use.

J. O. Eisinger, Standard Oil Co. (Ind.), was the first to describe the apparatus employed by his company. He explained that a simplified method is used consisting of running the engine at wide-open throttle and obtaining knock die-out curves by the borderline method. He suggested that it would be useful to compare these curves with curves run by the same method on the apparatus described by Mr. Moller. He pointed out that the weakness of a method developed at the National Bureau of Standards in 1923 was that the wind load that is effective at high speeds was not easy to simulate. The Pure Oil method, he believes, meets this problem.

In the East, traffic density handicaps road testing just as much as inclement weather, A. J. Blackwood, Standard Oil Development Co., brought out. Especially is this so, he added, when it is desired to test at high speeds.

The device developed at his laboratory, Mr. Blackwood believes, is much simpler. The heart of the apparatus, he explained, is a box about 15 in. wide by 18 in. long incorporating a small electric motor with magnetic clutch and series of contacts which close one after another at 1-sec intervals. By adjustment of the field resistance on the dynamometer in this manner, he continued, the load can be changed to give the same effect in the test engine as in the engine of a car accelerating on the road. The device is automatic, he added; all the operator has to do is to change fuels and reset the spark.

It is better to run tests in cars than on test stands, believes Neil MacCoull, The Texas Co. One advantage, he pointed out, is the ease with which engine units can be changed. Another is that the job can be done mechanically and simply rather than electronically. He went on to give his reasons why one set of inertia weights will do for most cars and showed that sufficient air was obtained over the front of the car with the fan so that the wind velocity approximates the car speed very closely.

In his closure, Mr. Moller indicated that the step resistances employed in the apparatus described by Mr. Blackwood probably do not give as smooth acceleration as does continuously variable resistance. With reference to the time necessary to change engines, he told Mr. MacCoull that the apparatus was double-ended – an engine can be set up on one end while the other is being tested, the only adjustment being a shaft coupling. "We don't believe our method is the answer, but simply an adjunct to road testing," he emphasized. "With it, we can check a large number of fuels quickly and accurately, and get a quick picture of probable road performance."

Military Chiefs Want Inventions

OFFENSIVE weapons and defensive devices against attack are wanted by the Army and Navy. Although any and all ideas are acceptable, the military services are naturally eager to receive as many as possible from trained engineers whose suggestions will be practical. The National Inventor's Council, Washington, D. C., has been set up to study all ideas submitted, and twelve technical committees of military and advisory personnel have been set up to review the ideas submitted, to study them, and determine which have possibilities in modern warfare.

Interviews with Army and Navy officers disclose that they hope ideas will come from automotive engineers which may be far more effective in offense and defense than anything the aggressor nations have thought up. A variety of inventions are needed to help strengthen our defense program. Engineers looking for something to invent will be interested in the following list of ideas on which to work:

Hydrocarbon vapors as an explosive.

Rocket-propelled projectiles.

Air, centrifugal and electromagnet guns.

Automatic mines for land and sea.

DEFENSE IMPACT ON INDUSTRY

Searchlights, mobile landing field flood lighting.

Special automotive equipment for simplifying servicing of motor vehicles, aircraft, etc., and improved motorized repair shop equipment.

Improved tank design.

Better aircraft brakes.

A lubrication system that will keep an aircraft engine lubricated during the first few minutes of a dive.

An aircraft turbine engine that will be lighter than present engines.

More efficient aircraft propellers.

Improved aircraft engine pumps.

Lighter hydraulic power equipment for aircraft.

Aircraft catapults and retarding devices.

Ice-prevention devices.

Refueling equipment.

Remote-controlled aerial and marine torpedoes, land vehicles and ships, and remote control for other combat weapons.

Improved gun and bomb-sights, optical and otherwise.

Devices to locate objects by sound, heat, radiant energy, or other known or unknown rays.

Spring motors or other prime-movers.

Destructive chemical compositions and high-powered explosives.

Minesweeping devices.

Aircraft-engine automatic valving devices for heat-exchange and intercooler units.

Anti-aerial bomb protection for cities, buildings, and ships.

Light, protective armored clothing.

Improved automatic anti-aircraft guns and small arms.

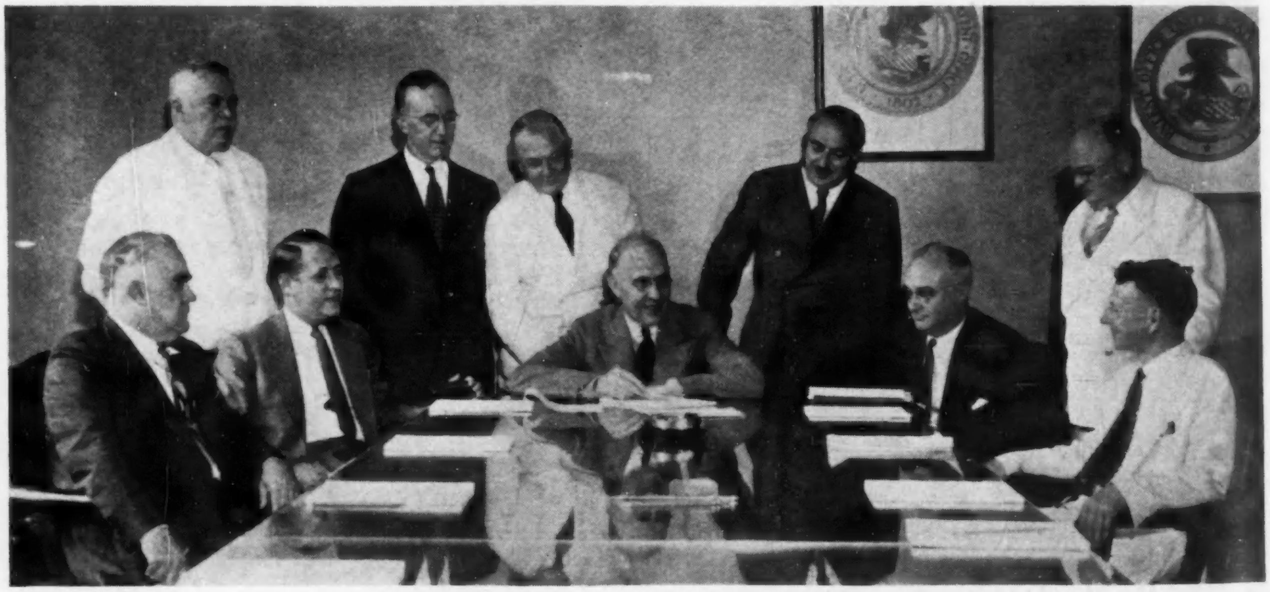
Effective gasoline-injection equipment to serve as an improvement over cabruretors.

Metal extraction and refining processes to use some of the low-grade ores which abound in the U. S.

Satisfactory welding of sheet aluminum alloy, and other improved machinery for fabricating these alloys.

(Let the reader add anything calculated to be effective in national defense.)

Supervising National Defense Inventions



Under the general supervision of the National Inventors Council of the U. S. Department of Commerce, more than 150 ideas a day are being studied and referred to the military services most interested. Pictured here are, left to right: Fred M. Zeder, vice chairman, Chrysler Corp.; Dr. Fin Sparre, director of development and a director of E. I. du Pont de Nemours Co.; Conway P. Coe, Commissioner of Patents; Dr. Webster N. Jones, director, college of engineering, Carnegie Institute of Technology; Dr. Frederick M. Feiker, dean, school of engineering, George Washington University; C. F. Kettering, chairman of the Council and vice president of General Motors Corp.; Lawrence Langner, secretary, and executive secretary of the National Advisory Council to the Committee on Patents, House of Representatives; Dr. Thomas Midgley, Jr., vice chairman of the Council and vice president of Ethyl Gasoline Corp.; Watson Davis, director, "Science Service"; and Dr. William D. Coolidge, vice president and director of research, General Electric Co. Other committee members, not shown, are George Baekeland, vice president, Bakelite Corp.; Rear-Admiral Harold G. Bowen, senior member, Navy Department Council for Research; Major-Gen. J. O. Mauborgne, Chief Signal Officer, U. S. Army; Major-Gen. W. H. Tschappat, former Chief of Ordnance, U. S. Army; Dr. Orville Wright, director of the Wright Aeronautical Laboratory. SAE members among these are Messrs: Kettering, a past president, Midgley, Wright, and Zeder

Sub-Contracting!

WHAT'S wrong with the present subcontracting for national defense?

Plenty, say thousands of manufacturers and OPM officials.

First, too few executives know we are at war, according to Joseph L. Trecker, hard-hitting machine tool manufacturing executive of Milwaukee and consultant to the Defense Contract Service of OPM.

"We've seen nothing yet. Contracts to date are only a drop in the bucket," he said. "Therefore, subcontracting has only scratched the surface."

In the second place, his hundreds of factory visits and thousands of miles traveled have demonstrated to him a grim fact:

Few manufacturers know what subcontracting means, and *fewer* have tried to find out.

Here's his definition of subcontracting: *"Any work done by outside facilities which normally would be performed on the equipment of the prime contractor, and which may or may not be the normal product of the secondary-contractor."*

Here's how to find out, in his opinion, what subcontracting means:

"Make each subcontractor a new department of your business. Set up a subcontracting board of a production executive, design engineer, financial man, and a plant engineer – and pick the best men you've got on your payroll to serve in this group. Remember, it's a new department. You must free them all from other assignments.

"Assign this group to visit the plants of potential subcontractors – large and small. Let them look over the building, machinery, and the type of product being made by this manufacturer.

"This group will decide what part this plant can best make. Then go over the problem carefully, step by step, from securing materials, advice on plant expansion, through manufacturing processes and inspection of the finished part."

Hundreds of contractors on government work have reported that prospective subcontractors were unable to produce the work required. But on investigation his department found:

1. Most of the prime contractors had turned over their toughest and nastiest jobs, expecting the prospective subcontractor to do things the prime contractor himself couldn't do well.

2. Most of them simply sent around blueprints and asked for bids. They accepted the lowest bid and then "threw in the sponge and said it couldn't be done when mistakes were made on the pilot order."

3. Few made any genuine attempt to go over the product with the prospect.

"Yes, some of these contractors are known in their fields as well-managed, successful businesses. Not one of them would have attempted to develop a new department or a new product in such a haphazard fashion. Yet none of them want to see this national defense effort fail," he said.

But this is a costly procedure, he was reminded.

"No war millionaires are coming out of this fight.

"If Hitler catches us with our plants down, we'll have nothing left in this country – not even our geography."

Now, he insists, is the time to organize subcontracting facilities and send them pilot orders. Management must be trained to handle their subcontracting units, and the time to get that experience is *now* – before the country's manufacturing facilities get crowded.

"Smart manufacturers are beginning to see the handwriting on the wall. Those who get in the subcontracting ground floor will discover:

1. They will eliminate the dead-loss of excessive capital structure following this emergency effort;

2. They will be able to handle the huge demands which will be placed upon them within a few months;

3. They will get the cream of subcontracting facilities.

Emphasizing the facilities of the Defense Contract Service set up to help subcontractors in technical, financial, and management problems in connection with government orders, Mr. Trecker said that DCS offices in the 36 Federal Reserve Banks throughout the country should be considered by potential manufacturers of military equipment their most important point of immediate contact with the government.

DON'T LET THEM CATCH US WITH OUR PLANTS DOWN

Fighting paraphrase of "God Bless America" and "Home Sweet Home" displayed in several OPM offices in Washington, D. C.

Segregating Aluminum And Bootlegging Scrap

Great Britain is using for defense purposes from 85 to 90% of aluminum shop scrap by a system of careful segregation by alloy content. Plainly marked boxes at each machine where metal is removed from the part are collected and the various alloys are kept segregated until returned to the aluminum plants. Here about 40% virgin aluminum, 40% mill scrap, and 20% of shop scrap comprises the new melt.

Voluntarily, or by OPM edict, such segregation is in the offing for U. S. plants, observers agree. (Such segregation is an old story with some steel and non-ferrous plants.)

However, those most concerned with aluminum shortages for aircraft are impatient with the publicity given to the nationwide program of scrap pots-and-pans collections, where segregation of alloy content is impossible. Richmond, Va., and Madison, Wis., were trial balloons and dug up large tonnages. This may supply secondary and tertiary grades, but will not help the critical needs of primary aluminum alloys for aircraft and aero engines.

Under date of June 10, OPM issued an order prohibiting delivery of aluminum scrap for melting or processing unless such delivery has been assigned a preference rating of A-10 or higher. This puts aluminum scrap under full priority, channeling the metal to national defense use.

The demand for primary and secondary aluminum has disclosed widespread bootlegging among scrap dealers, recalling NRA days.

OPM announced, in general, that fabricators should substitute those metals less scarce that were replaced by aluminum:

a. Oiled paper, glassine, or cellophane for aluminum foil;

b. Paper caps from aluminum bottle caps;

c. Steel, glass, cast iron, pottery for kitchen ware;

d. Copper bus-bars and high tension wires.

Recommendations:

a. Instead of selling aluminum scrap to scrap dealers, bypass them and send it to aluminum producers who will melt it for a fee. This will require careful segregation.

b. Use thinner gages in all non-military products.

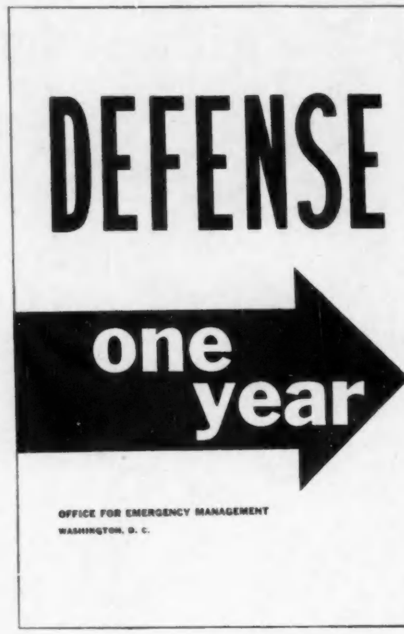
c. Use more manganese alloy (3S) instead of purer alloys.

d. Educate employees to reduce scrap and spoilage.

Several aircraft manufacturers reported to the SAE Journal that spoilage and scrap is reduced in direct proportion to the experience of the workmen.

Estimated 1941 primary gross aluminum production by Alcoa:

MONTH	TOTAL POUNDS
March	42,645,000
April	45,160,000
May	49,595,000
June	49,735,000
July	52,025,000
August	52,275,000
September	50,840,000
October	52,685,000
November	51,200,000
December	53,065,000
TOTAL—March to Dec. inc.	499,225,000



Progress report of one year of defense effort, available free from Office of Emergency Management, New Social Securities Bldg., Washington, D. C.

Unlimited Emergency Means Vast Powers

AT least 200 Federal laws, some stemming from the Revolutionary and Civil War eras, require the President to exercise the widest authority in the nation's history when, in his opinion, it "becomes necessary to do so," spokesmen of the Attorney General's office explained to the SAE Journal. Among the hypothetical things the President is called upon to do which he could not have done before May 28, when he proclaimed that an unlimited emergency existed, are:

1. Take over any and all motor-vehicle fleets "necessary to move military forces," and for the transportation of both military and civilian supplies and populations.

2. Suspend any or all provisions of laws prohibiting more than eight hours of labor in any one day by persons working on contracts with the U. S. Government. It was pointed out that these may not necessarily be military contracts, but that the President's new powers are equally applicable to manufacture of products he deems necessary to the national welfare.

3. Require the Interstate Commerce Commission to remove interstate barriers of transportation of war materials and products.

The recent taking over of the North American Aviation plant in Inglewood, Calif., demonstrated the broad legislative and constitutional foundation upon which the President acted. It was explained that this authority has always been vested in the President of the United States, although this was the most dramatic instance of its implementation during recent years. Many states give their Governors such authority, enforceable through the National Guard.

A key to the President's powers lies in the phrase from the Constitution which calls upon the incumbent "to take care that the laws be faithfully executed." By reciting the persistent defiance of governmental efforts to mediate any legitimate labor differences at the North American plant, for example, the President established the fact that the situation there resembled an insurrection more nearly than a labor strike.

Analyzing the President's powers, the Department of Justice pointed to the broad specific requirements of the President imposed by the Lend-Lease act. Furthermore, as Commander-in-Chief of the Army and Navy, he is supported by a large body of old and newer war-time legislation as well as by the Constitution itself. "These laws for the protection of the continued existence of the nation are placed in his sole command, and the implication is clear that he should not allow them to become paralyzed by failure to obtain supplies for which Congress has appropriated the money and which it has directed the President to obtain," the Department said.

"There can be no doubt that the duty constitutionally and inherently rested upon the President to exert his civil and military authority to keep the defense effort of the United States a going concern," the statement concluded.

Defense-O-Grams

PROVISIONS OF THE WALSH-HEALEY ACT OR THE EIGHT-HOUR LAW ARE INCORPORATED INTO MOST GOVERNMENT CONTRACTS. THIS REQUIRES A CONTRACTOR TO KEEP CERTAIN LABOR RECORDS, PAY OVERTIME FOR WORK IN EXCESS OF EIGHT HOURS IN ANY ONE DAY, AND MORE THAN 40 HOURS IN ANY ONE WEEK. BUT THIS PROVISION DOES NOT APPLY TO THE SUBCONTRACTOR, INASMUCH AS HE HAS NO CONTRACT WITH THE GOVERNMENT, BUT ONLY WITH THE PRIME CONTRACTOR.

★

GEN. L. B. HERSHEY, DRAFT DEPUTY, REPROVED EMPLOYERS FOR ALLOWING SKILLED WORKERS TO BE DRAFTED. SAID HE: "SUPPLY NECESSARY DATA ABOUT NECESSARY MEN, WORKING ON DEFENSE CONTRACTS TO YOUR LOCAL DRAFT BOARD."

★

STRIKES HAVE COST THE U. S. DEFENSE PROGRAM NEARLY 18 MILLION MAN-HOURS FROM FIRST OF YEAR TO DATE, ARMY SAYS. NAVY LOSS MAY EQUAL THAT, BRINGING TOTAL TO 36,000,000 MAN HOURS.

★

FIRST 20-MM AUTOMATIC AIRCRAFT CANNON EVER BUILT IN U. S. WAS PRONOUNCED SUPERIOR TO ANYTHING IN EUROPE BY ARMY OFFICIALS WHO ACCEPTED IT FROM THE ECLIPSE-BENDIX PLANT, ELMIRA, MAY 16.

Urges Mechanic Course in CCC

SPEAKING as a manufacturer, SAE President A. T. Colwell testified before the Senate Subcommittee on Education and Vocational training in favor of extending the program of the Civilian Conservation Corps to include the training of enrollees as automotive repair mechanics on June 11 in Washington, D. C.

"Manufacturers are facing a severe shortage of men with mechanical aptitudes," he said, "both in the factories and in the motor-vehicle transportation industry. This shortage is going to be more and more severe," he predicted.

"We are employing 130 former CCC enrollees in our plants in Cleveland, and I am told by our personnel manager that they are unusually well disciplined, and show every indication of advancing faster than the other young men," he continued.

Quoting T. L. Preble, vice president of the Society in charge of the Transportation & Maintenance Activity, Mr. Colwell estimated a severe shortage of trained mechanics in the highway transportation business as soon as the Army began to call to service experienced mechanics from the garages. "Industry will be forced to replace these trained men with younger men. If operators could choose men from CCC enrollees who have been given preliminary repair training, they would have a better chance to carry on the highly important job of shipping both military and civilian supplies," he said.

Upon direct questioning of Senator LaFollette, Mr. Colwell assured the Subcommittee that he was sure the Society could be of invaluable aid to the armed forces of the United States, if and when, called upon to do so.

The Senate Bill, as written, requires the establishment of 300 CCC schools. Both the CCC administration and the Army would prefer this stipulation be deleted before the law is passed. Following a series of hearings, the bill will be submitted to the Senate, and referred to the House. There are several companion House bills under consideration, the hearing disclosed. The Army, previous hearings disclosed, is in favor of the idea of CCC auto mechanic training.

Senators Aiken (Vt.) and McCarran (Nev.), the author of S1365, were present. Others who had been invited to testify were W. T. Piper, president, Piper Aircraft Co., and C. Don McKim, executive vice president of the National Standard Parts Association. Both concurred with Mr. Colwell that such training as proposed in Mr. McCarran's bill would serve the best interests of the national defense effort.

How Army Buys Trucks

Everyone interested in the procedure used by the U. S. Army in buying and testing trucks, will find on page 18, a review of this subject in an abstract of a paper presented by Capt. J. E. Engler, QMC, delivered at the SAE Summer Meeting.

SAE President at Senate Hearing

Harris & Ewing

Agreeing with James J. McEntee (right) director, Civilian Conservation Corps, that S1365, introduced by Senator McCarran (Nev.), providing that the Corps should undertake to instruct enrollees in automobile repairing, are shown C. Don McKim, executive vice president, NSPA; W. T. Piper, president, Piper Aircraft Co.; and A. T. Colwell, SAE president and vice president of Thompson Products, Inc., who had all testified in favor of such a program to train men who could be employed to replace experienced maintenance men called for military service

Might License Factory Agents

OPM officials believe that well-organized manufacturers' agencies are important in the national defense effort, but they view the field as a mixed blessing because:

1. Too many have sold their clients in the hinterlands on their prowess to make contacts with the "right people" in securing government orders.
2. Too few have staffs of experienced factory engineers who can interpret the manufacturing techniques required by military products in terms of their clients' manufacturing experience, plant, machine tools, and factory supervision.
3. Too many spend most of their time attempting to contact top OPM executives, rather than discussing detailed problems with the technical assistants in the various divisions of OPM. (It takes no crystal-gazing, the SAE Journal was told, to see that the reason for this is to write reports to impress their clients.)

Some spokesmen of official circles in Washington are already talking about licensing manufacturers' agents, basing the requirements on such factors as technical qualifications of the engineers working for the representative and capacity of the representative to distribute orders to manufacturers who can get equipment produced to the specifications, *and on time.*

Use Moly, Says OPM

If molybdenum steel tools can be used, manufacturers may not buy tungsten steel, a new OPM substitution order stipulates. About 20,000 tons of tungsten are consumed in normal times in the U. S. in high-speed steels. More than half of this is used by the automotive industry, a pioneer in faster metal cutting practices.

Auto Plant Safety Record Stands High

Despite the pressure of putting many new defense items into production and shifting thousands of men to these new jobs during 1940, frequency of injuries in the automobile plants decreased by 5%, according to the National Safety Council. The number of days lost per 1000 hr of exposure (severity rate) increased, however, by 3%. The automobile severity rate, nevertheless, was just about half that of the average for all industries combined.

Civilians' Ideas Have Won Wars

Inventors of arms have chiefly been civilians: Gatling built planters long before he brought out his rapid-fire rifle; Maxim was first known for his carburetors; Lake drew on his marine architecture for his submarine; the Wright brothers profoundly changed military tactics after Kitty Hawk; gunpowder entertained millions of Chinese in pyrotechnics before it was used in cannon; Vieille, a French cosmeticist and chemist, made the first smokeless gun powder; Nobel, shocked by the use of his invention of dynamite in warfare, set up the Peace Foundation bearing his name; Eli Whitney's cotton gin and machine tools antedated his rifle, and the first tanks used by the British in World War I were Caterpillar tractors from Peoria, Ill., armored.

Automobile-Aircraft Defense Merger; British Engineers' Part in War Stressed

■ *Detroit*

"It took the automobile industry 30 years to make itself the biggest industry on earth and now the aircraft industry is expected to be twice as big as the auto industry in 18 to 24 months." . . . "British automotive engineers have a tough situation to face. It is bad enough to make decisions for defense with the complexities of a peacetime outlook, but when you complicate the situation further by not having plenty of anything but aircraft, the headache is large-sized."

These quotes keynoted the two dramatic speeches delivered before more than 450 SAE members at the Detroit Section Meeting, Statler Hotel, on May 19. The first was from an analysis of the relationship of the automobile and aircraft industries in National Defense by the president and editor of *Iron Age*, John H. Van Deventer; the second was from Alex Taub's "Inside That Fortress With Britain's Automotive Engineers." Mr. Taub is a special representative of Lord Beaverbrook.

Van Deventer Views Aircraft

The aircraft expansion program, according to Mr. Van Deventer in his talk, "Tolerance Versus Tolerances," contemplates a production rate of 30,000 units a year by the middle of 1942 and 50,000 units during 1944. That means that in the next 12 months four out of every six machine tools will be commandeered by the aircraft industry and that by the end of next year aircraft production will be absorbing the direct efforts of 800,000 workers.

The successful fulfillment of this tremendous undertaking, which Mr. Van Deventer expressively labeled "the nearest thing to the job of Creation that man has yet attempted," resolves itself down to this: there must be a free exchange of ideas and information between the various plane factories and between the aircraft industry and the automobile industry. "Only through cooperation of the most intense kind," Mr. Van Deventer said, "can the job be done... The problem we are up against is to gear the thinking of the aircraft concerns to much larger lots in production than they have been accustomed to, and the thinking of the automobile concerns going into this industry to the handling of much smaller lots than they have been accustomed to, with the objective of cross-transplanting from one to the other the ideas and methods best suited to the most efficient attainment of that purpose." He felt the SAE could be especially helpful in bringing this about.

Two factors will stand in the way of mass production of aircraft on a scale comparable to automobile output, the speaker said: (1) No one in the United States can "freeze" design of military aircraft and, (2) there will be a shift to the heavier types of planes as the program continues.

In reference to the first problem, Mr. Van Deventer said, "I heard the other day, on good authority, that 143,000 design changes had been made in a certain plane in order to gain, among other advantages, 3 mph in its top speed. Some of them were very minor changes, of course, but you know what even minor changes do on a production line. Well, 3 mph may mean a lot to a pilot who has somebody riding his tail or vice-versa. . ." and further along, "No one in America has authority to 'freeze' aircraft designs. The President cannot do it, the Army and Navy cannot do it, and Bill Knudsen cannot do it. The only man in the world who can do it is Mr. Hitler, and he won't do it."

The speaker emphasized the future slow-up of production through construction of larger planes, thus: "Consider our proposed program of 500 flying fortresses a month. One of these units weighs, complete, 22 tons. This means the delivery of 66,000 tons of aluminum a year or one-sixth of the total expectable production of 1941.

"The most conservative and optimistic estimate of the man hours required is 100,000 per air frame. Four thousand man hours per motor, and there are four motors, add up to 16,000 per plane. And by the time you consider the landing gear, mechanical accessories, armaments and instruments, one of those units will take the expenditure of 150,000 man hours."

Even at this stage of the game the automobile industry is making valuable contributions to its ally, the aircraft industry. Mr. Van Deventer listed Chrysler's aluminum forgings; Ford and Dow's capacity production of magnesium castings; Briggs' mechanical dies on air frames; the abolition of rivets from aircraft parts and the substitution of spot welding which has given three to six-mile increase in speed of planes, among the outstanding recent developments.

Of special interest was the speaker's views of what will happen when the emergency is over. He did not believe the automobile industry will absorb the aircraft industry.

"I don't think the car makers will want it," he said, "they are babes in arms when it comes to design and aerodynamics. And it has been proven before that the auto industry cannot build anything profitable except autos and trucks.

"However, one thing I'm certain of: If we do not carry out the program laid down before us, neither the aircraft nor the auto-

Spring Outing of Southern New England Section

John A. C. Warner, general manager of the Society, John G. Lee, retiring chairman of the section, and SAE President A. T. Colwell, on the porch of the Shuttle Meadow Country Club, New Britain, Conn., May 22, when the outing was in full swing. In the evening prizes for the day's events were awarded and President Colwell spoke on the topic, "Behind the Scenes in National Defense Engineering"

mobile industry will own it. Mr. Hitler will!"

(Excerpts from Mr. Van Deventer's talk appear on p. 293 of the Transactions Section of this issue.)

Taub Cites English Unity

Cooperation between the representative of the military services and the production units has become much closer in England since the outbreak of hostilities, said Alex Taub, special representative of Lord Beaverbrook and first speaker of the evening. "No longer can horse-minded generals do what they want without being questioned." On the other hand, he told the engineering group, "the manufacturer of war units knows that he cannot hide behind specifications furnished him by one of the services. His product must work; so he, by virtue of his experience, can fight it out with a specification writer. The result is that experts of the services meet experts of industry on level ground and hammer things out until each is satisfied."

Close contact with combat improves an engineer's perspective, Mr. Taub stated. "You learn first that the boys are playing marbles for keeps and you don't make decisions off the end of the slide rule. You also learn quickly that tactics are vitally important – in fact, just as important as continuity of production. Modification of a program is a headache. So is war. Therefore, you have to compare headaches. If continuity of production creates bigger headaches than it relieves, you will change it. You get used to the idea that today's rush may be the obsolescence of tomorrow, and no matter how hard you have worked you must be mentally agile and sentimentally honest."

Mr. Taub said that priorities naturally exist, but stressed that, "although your project may not have a high priority, it does not mean you can fail to deliver." By way of illustration, Mr. Taub said that if aircraft is a higher priority than military trucks, military trucks must still be produced and it is up to the engineer to see that they are produced. "Sure it gets tough," he admitted, "at times damn tough, but that is your pigeon and you get on with it."

Miles per gallon became a demand with the rationing of fuel to the public, Mr. Taub stated; a howl went up for more miles per drop of fuel.

"We got down with the carburetor, spark plugs, compression ratio, axle ratio, etc., but the most important thing was by teaching folks how to drive." This was not as difficult as it sounds, Mr. Taub said. It was solved largely by putting an electrical contact on the carburetor and a red light on the dash, which lit up. If the motorist drove by the light, a fuel saving of 15% and sometimes more could be obtained.

The nerve-racking conditions under which automotive engineers in England must work were graphically portrayed by Mr. Taub. As every engineer is doing duty with one of the forces, or auxiliaries, the A.R.P. or Home Guard, he said that they must work over the drafting board in bulky uniforms, with their equipment and gas masks close at hand. Some even carry their work into air raid shelters.

With reference to America's part in the war, Mr. Taub said, "Much is needed in the way of ships and competent aircraft which can only be answered by production and more production. We must remember at all times, however, that behind each piece of fighting equipment is a fundamental idea. Ideas are the real weapons of this war. We must learn to steer the great American production ability and capacity through the winding and tortuous path of changing ideas."

Indiana Applications Lead Membership Quota Contest

Indiana, *first;* Cleveland, *second;* Detroit, *third;* Northwest, *fourth.* That's the final January-to-June standing of the Sections' battle of quotas in getting qualified SAE prospects to submit applications for membership. For the same period, total applications for membership soared to a record high.

These facts were revealed by National Membership Chairman R. F. Steeneck at the joint Membership-Sections Meeting at the 1941 Summer Meeting. He explained that a new effort is under way, that revised quotas have been set, and that the contest will continue to Dec. 15.

The quota system has been established on a percentage basis to eliminate, in so far as possible, the size element in comparison of Section membership accomplishments.

On the basis of actual number of applications obtained during the section year, June 1, 1940, to May 31, 1941, Metropolitan Section was first with 201 applications, *a new high;* Detroit, second, with 163; Southern California, third, with 106; and Cleveland, fourth, with 98.

Roller Bearings In Defense Discussed By Buckwalter

▪ *Washington*

"The outstanding surprise of World War II is the tremendous striking power of the Panzer divisions, and the foundation of this striking power is the efficient combination of tanks and aircraft; and beyond that – gasoline and roller bearings," declared T. V. Buckwalter, vice president, Timken Roller Bearing Co., in speaking to the Washington Section audience May 13. America has been chiefly responsible for the mass production of the motor transport and the development of the roller bearing, he said, and expressed confidence that the United States would assume world leadership in the development of military transport power in a reasonable time.

"One of the fundamental concepts of bearing usage," Mr. Buckwalter said, "is that they must be mounted in pairs, and a second is that the bearings accommodate any combination of thrusts and load. For high thrust reactions the bearing is made with steep shear."

According to Mr. Buckwalter, the application of pre-loaded roller bearings to machine tools, particularly lathe spindles, has improved the quality of finish and greatly extended the life of the tool.

The first complete roller-bearing locomotive was built by Timken to demonstrate the advantages of roller bearings in severe service. Likewise, roller bearings were applied to steel rolling mills, where bearing loads are measured by millions of tons. Bearing wear has been negligible, Mr. Buckwalter reported, after rolling hundreds of thousands of tons of steel. This application has revolutionized the industry, he declared, and is a military asset of tremendous importance.

Bearings are rated in accordance with speed factor, life factor based on expected life, and application factor, depending upon the character of the loading, he explained, pointing out that a life factor of 1 corresponds to failures of not over 10% in 3000 hr. Bearings should be selected so that their life will equal that of the machine, Mr. Buckwalter said.

By means of photo-elastic pictures, he showed that the highest stress on bearings occurs in a zone materially under the surface of the rolling elements. Great resistance to destruction and flaking is required in the zone of high stress, Mr. Buckwalter pointed out, adding that this is obtained by heat treatment so that a gradual transition from hard case to tough case results.

Says High-Speed Planes Demand "Stiffer" Engines

▪ *Indiana*
▪ *Detroit*

Future engine structural changes will center around the problem of building an engine "stiff" enough to perform satisfactorily in the high-speed aircraft of today, according to R. M. Hazen, vice president and chief engineer, Allison Division, General Motors Corp., at a closed meeting of the Detroit Section, Hotel Statler, April 28, and again at a regular meeting of the Indiana Section, Antlers Hotel, May 16.

He pointed out that cylinder head cracks were found in earlier Allison models which were designed only for the explosion loads of each cylinder, adding that the cracks showed clearly that there had been bending of the whole engine due to inertia forces acting on the plane's engine in the air. Mr. Hazen predicted that "en bloc" cylinder construction would prove lighter and stiffer than construction which makes use of individual cylinders, as is typical in all present-day airplane engines.

History of the development of the Allison aircraft engine – the only liquid-cooled military airplane engine available to the United States – was the main subject of Mr. Hazen's talk. He gave a review of discoveries made by Allison which hint at important structural changes which may be expected in such engines in the near future, and gave engineers a diagram of the labyrinthian paths through which designers, experimental workers and production men must toil before they can produce any acceptable airplane engine in the higher power brackets.

The trend in twin-engined airplanes is toward powerplants that rotate in opposite directions, Mr. Hazen stated, so that torque effect of one engine is offset by having its mating engine revolve in the opposite direction.

Interest is also high in the field of dual-rotation propellers, Mr. Hazen indicated. Among aircraft designers it is already widely acknowledged that such propellers, using opposite rotating sets of blades on a single propeller axis, are the next step to permit use of higher output power units.

Turning to the subject of problems of the supplier of an airplane engine intended for general use in a number of types of aircraft, Mr. Hazen said, "He must face, after the basic engine is developed, a long period of expensive cut-and-try to adapt the engine to various airplanes." The only way to speed the process and obtain more ready acceptance, Mr. Hazen said, is through closer coordination in the design of the airplane and its engine. Thus the combines which have both engine manufacturing plants and plane fabricating units

are in the most favorable position in this respect.

Since Allison started late in 1930 on its initial work on the V-type, high-output engine, the powerplant has been stepped up from 650 hp without supercharging to 1000-1500 hp in its present supercharged state, and has also grown in weight from around 1000 lb to about 1320 lb, Mr. Hazen said.

The engine originally envisioned was a completely reversible powerplant to meet the requirements of dirigible installations; such as were used in the "Akron" and "Macon." According to Mr. Hazen, this original engine was designed to come to a full stop, reverse, and then reach full power in the opposite direction in 8 sec.

When the "Akron" and "Macon" were destroyed, Mr. Hazen said, GM purchased Allison, and interest in the engine began to center largely on its possibilities for planes.

General Motors of Canada To Double Engineering Staff

▪ Canadian

Two hundred and eighteen members and guests attending the annual Oshawa dinner meeting of the Canadian Section in the Genosha Hotel, May 16, were informed by Col. R. S. McLaughlin, president, General Motors of Canada, that the over-burdened engineering staff of General Motors of Canada will be increased two and three-fold as part of the corporation's contribution toward helping the British Empire end "this hellish war."

They also heard a rousing tribute to the staying power of the English people under fire by Major-Gen. A. Macrae, O.B.E., adviser to the Canadian Ministry of Munitions and Supply – witnessed the installation of a newly-elected chairman – and listened to a sparkling address by Alexander Gray, president, Gray Forgings and Stampings, the "Will Rogers of Canada," pinch-hitting for the speaker of the evening, H. J. Carmichael. Mr. Carmichael had been called to Washington on urgent war business while en route to Oshawa.

Major-Gen. Macrae graphically described instances he had witnessed illustrative of the indomitable spirit of the British people – a full dress marriage solemnized in the midst of the debris of a bomb-gutted church; a Bond Street milliner whose three successive establishments had been bomb-blasted and who, though buried by the falling rubble of the last of these and dug out, apparently more dead than alive – resumed her business in a fourth location after three days of hospitalization; a proprietor of a time-honored establishment in Paternoster Row, former home of world-famed publishers, who the morning after buildings on the Row had been razed by fire and bombing, remained "polishing the brass handle of the big front door" which, with its masonic frame, stood alone midst the desolation caused by the fire-blitz on "The City" the night before, Jan. 29.

Retiring chairman, Norman Daniel, general service manager, General Motors of Canada, opened the meeting and presided during the business session, at the conclusion of which he officiated in the installation of the newly-elected chairman, R. W. Richards, Toronto, general sales manager, Goodyear Tire & Rubber Co. of Canada.

The late R. H. Combs, "Father of the Canadian Section," and its first chairman, was the subject of brief eulogy by retiring Chairman Daniel and Secretary Warren B. Hastings. The gathering stood with bowed heads as a salute to his memory.

Among the head-tableites were: His Worship Mayor J. C. Anderson of Oshawa; J. L. Stewart, Canada's Assistant Oil Controller and general manager of the Canadian Chamber of Commerce, and a past section chairman; W. H. "Dad" Moyse, first engineer of General Motors of Canada; Lt.-Col. R. B. Smith, O.C. 2nd Battalion, Ontario Regiment (Tank); and A. A. Maynard, director of engineering, General Motors of Canada, and prior to the outbreak of hostilities, the engineering director of General Motors manufacturing enterprises in Germany.

SAE Coming Events

Sept. 25 – 26	**National Tractor Meeting** **Schroeder Hotel – Milwaukee, Wis.**
Oct. 23 – 24	**National Fuels & Lubricants Meeting** **Mayo Hotel – Tulsa, Okla.**
Oct. 30 – 31 & Nov. 1	**National Aircraft Production Meeting (and Engineering Display)** **Biltmore Hotel – Los Angeles, Calif.**
Nov. 5 – 6	**West Coast Transportation & Maintenance Meeting** **San Francisco, Calif.**
Nov. 13 – 14	**National Transportation & Maintenance Meeting** **Statler Hotel – Cleveland, Ohio**
Jan. 12 – 16, 1942	**SAE Annual Meeting (and Engineering Display)** **Book Cadillac Hotel – Detroit, Mich.**

Stout Sees Aviation Transforming World

▪ No. California

As the automobile transformed the world of today, so the airplane will transform the world of tomorrow, stated William B. Stout, president, Stout Engineering Laboratories, Inc., to an interested gathering of the Northern California Section at the Hotel Leamington, Oakland, May 13. The famous inventor said the widespread switch to transportation by air will ultimately bring about the dispersement of our urban population; a disappearance of ocean-bound traffic with the resulting gradual decline of coastal cities; trade routes running North and South rather than East and West; and a revision in our systems of living.

A vast commercial development, coupled with an almost undreamed of increase in private flying, will force the scattering of our city populations. Some states, stated Mr. Stout, have already started a scheme of strip landing fields along major highways next to filling stations and this program, backed as it is by the Federal Government, is already making possible extensive cross-country flights by amateur plane owners.

Defining a commercial plane as one which supports itself in the air financially as well as mechanically, Mr. Stout foresees a commercial development of great magnitude. Our present long-range bombers, admittedly the best in the world, will be easily adaptable to airline travel. Large ships, such as the new "Douglas," will be able to transport freight cheaper per ton mile than any other means of transportation.

In predicting a complete technical control for the world of tomorrow, Mr. Stout pointed out that the present war is proving to be a great stimulus in that direction. China and Germany have been forced into technical development, while those nations which failed to undertake research have already fallen. While we have yet only scratched the surface of technical development, the Research Divisions of our government cannot be beaten by any other commercial or government agencies in the world, stated Mr. Stout.

Technical control of the world of tomorrow will extend to every country and will be unaffected by difference of race, nationality and age, he said, adding that such a technically controlled world would force us to revise our systems of living.

The new world based on technical knowledge and progress will be shrunk to 1/5 its present size due to the coming development in aviation. Engineers will have an important place in that world, stated Mr. Stout.

Discussion under the technical chairmanship of William Hanley, Standard Oil Co. of Calif., centered mainly on details of the plane Mr. Stout is now developing. One hundred two-seater planes a day, of 100 hp each, with a speed of 120 mph, and costing

(Concluded on page 60)

APPLICATIONS Received

The applications for membership received between May 15, 1941, and June 15, 1941, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Chicago Section

Boldt, Kenneth, test engineer, Pure Oil Co., Winnetka, Ill.

Hungerford, Norman C., radio department foreman, United Air Lines Transport Corp., Chicago.

Penfold, Norman Charles, director, engine laboratory, Armour Research Foundation, Chicago.

Schroeder, Ed., flight engineering, United Air Lines Transport Corp., Chicago.

Cleveland Section

Bartlett, Kenneth M., research metallurgist, Thompson Products, Inc., Cleveland.

Bower, Milton R., manager, lub. sales, Standard Oil Co. (Ohio), Cleveland.

Gawain, Theodore Henry, tire development engineer, Firestone Tire & Rubber Co., Akron, O.

Gray, Robert, assistant engineer, The Leece-Neville Co., Cleveland.

Kramer, Karl, chief draftsman, The Leece-Neville Co., Cleveland.

Musgrave, F. F., director of chemical research, Lubri-Zol Corp., Wickliffe, O.

Schmelzer, J. F., tool engineer, Thompson Products, Inc., Cleveland.

Dayton Section

Berger, Adolph L., mechanical engineer, Air Corps, Materiel Division, Wright Field, Dayton, O.

Gates, Richard Lawrence, chief draftsman, Curtis Pump Co., Dayton, O.

Ross, Donald M., assistant mechanical engineer, War Department, Materiel Division, Wright Field, Dayton, O.

Detroit Section

Black, Carl B., vice president, Standard Steel Spring Co., Detroit.

Cook, William P., sales engineer, Marvel-Schebler Carburetor Division, Borg-Warner Corp., Flint, Mich.

Martz, Lawrence S., director, technical publicity, Micromatic Hone Corp., Detroit.

Swart, Clayton, engineer, National Stamping Co., Detroit.

Vigmostad, Trygve, body engineer, Briggs Mfg. Co., Detroit.

Indiana Section

Breting, U. Adrian, Jr., mechanical engineering draftsman, Allison Division, General Motors Corp., Indianapolis.

Kennedy, Logan H., engineer, The Perfect Circle Co., Hagerstown, Ind.

Klein, John J., head of patent department, Marmon-Harrington Co., Inc., Indianapolis.

Metropolitan Section

Barcelona, Anthony Richard, heat treater, Air Associates, Inc., Bendix, N. J.

Bonardel, Victor C., assistant sales manager, Titeflex Metal Hose Co., Newark, N. J.

Brault, Andre R., draftsman, research laboratory, Sperry Gyroscope Co., Inc., Garden City, L. I., N. Y.

Cram, Harkness Warren, sales manager, Aircraft Screw Products Co., Inc., Long Island City, N. Y.

Forbes, Thomas R., partner, A & T Auto Parts, Long Island City, N. Y.

Hamilton, Jack Irwin, project engineer, Curtiss Propeller Division, Curtiss-Wright Corp., Caldwell, N. J.

Heigis, Henry E., manager, engineering department, Walter Kidde & Co., Bloomfield, N. J.

Jordanoff, Assen, author, 125 E. 63rd St., New York City.

Keif, Aubrey, manager, aviation sales, The Texas Co., New York City.

Kretchmer, Louis, treasurer and secretary, K & G Auto Parts, Inc., Brooklyn, N. Y.

Luttrell, John C., assistant project engi-

neer, American Airlines, Inc., Jackson Heights, L. I., N. Y.

Moore, Hollister, manager, membership department, Society of Automotive Engineers, Inc., New York City.

Polkoph, Robert C., test engineer, Wright Aeronautical Corp., Paterson, N. J.

Redding, James D., staff representative on aeronautics, Society of Automotive Engineers, Inc., New York City.

Sargent, Robert S., transportation consultant, Ebasco Services, Inc., New York City.

Stockard, Raymond Harris, carburetor engineer, Wright Aeronautical Corp., Paterson, N. J.

New England Section

McDonald, Thomas F., automotive engineer, Socony-Vacuum Oil Co., Inc., East Providence, R. I.

Northern California Section

Salzman, Phil C., air safety investigator, U. S. Civil Aeronautics Board, Safety Bureau, Washington, D. C. Mail: 560 Blossom Way, San Leandro, Calif.

Northwest Section

Finney, O. T., sales engineer, Standard Oil Co. of Calif., Aberdeen, Wash.

O'Hara, Edward A., president, Edward A. O'Hara Production Engineering, Seattle, Wash.

Philadelphia Section

Kramme, Paul E., president, P. E. Kramme, Inc., Monroeville, N. J.

Serrell, John Jacob, engineering department, The Sharples Corp., Philadelphia.

St. Louis Section

Henning, Otto, sales engineer, Carter Carburetor Corp., St. Louis, Mo.

Moulder, Walter J., chief inspector, St. Louis Airplane Division, Curtiss-Wright Corp., Robertson, Mo.

Slattery, Robert O., sales engineer, Shell Oil Co., Inc., St. Louis, Mo.

Smith, Arnold H., assistant sales manager, Monsanto Chemical Co., St. Louis, Mo.

Stoehr, Alfred Franz, industrial representative, Sinclair Refining Co., St. Louis, Mo.

Southern California Section

Bunch, Charles B., service representative, The B. G. Corp., New York City. Mail: c/o Pacific Airmotive Corp., Lockheed Air Terminal, Burbank, Calif.

Buxton, Jarvis C., tool designer, Vega Airplane Co., Burbank, Calif.

Grenda, Albert, draftsman, Douglas Aircraft Co., Inc., El Segundo, Calif.

Hackney, Lyle Raymond, weight control staff engineer, Lockheed Aircraft Corp., Burbank, Calif.

Todd, William P., western representative, The Weatherhead Co., Cleveland, O. Mail: 317 S. Canon Drive, Beverly Hills, Calif.

Wells, Thomas M., senior tool planner, Vega Airplane Co., Burbank, Calif.

Southern New England Section

Doran, Philip David, sales engineer, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

Tsacoyeanes, Archie J., engine tester, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn.

Washington Section

Agerter, Harry, aircraft and sales manager, Engineering & Research Corp., Riverdale, Md.

Cleveland, Allen E., 1st Lt., Quartermaster Corps, Motor Transport Division, Washington, D. C.

Huester, Harry J., Lt.-Com., USNR, technical adviser, Reynolds Metal Co., Washington, D. C.

Outside of Section Territory

Baird, A. Lincoln, Lt., Naval Air Station, Ground School, Pensacola, Fla.

Hallam, Clyde M., Major, staff and faculty, Field Artillery School, Fort Sill, Okla.

Lesley, Hubert Glenn, maintenance engineer, Eastern Air Lines, Inc., Miami, Fla.

Foreign

Brooks, Douglas Gordon, field engineer, Vacuum Oil Co. of South Africa, Ltd., Johannesburg, S. A.

Doctor, Behram, transport officer, Bombay Municipal Corp., Bombay, India.

Jackson, Robert R., research department and engine development, Bristol Aeroplane Co., Bristol, England.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between May 15, 1941, and June 15, 1941.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section

Greaves, Gennard Alban, Lt.-Col. (SM) U. S. Army, Quartermaster Corps, Camp Holabird, Md.

Lawes, Herbert J. (SM) Lt.-Col., War Department, U. S. Army, Holabird Quartermaster Depot, Baltimore, Md.

Parker, Edward H. (J) layout draftsman, Glenn L. Martin Co., Baltimore (mail) 3615 White Ave.

Buffalo Section

Bush, John F., Jr. (A) vice president and general manager, Puritan Co., Inc., 573 Lyell Ave., Rochester, N. Y.

Sylvester, H. M. (A) secretary and treasurer, F. A. Smith Mfg. Co., Inc., Rochester, N. Y. (mail) 400 Davis St., Post Office Box 509.

Chicago Section

Baumler, J. O. (M) division head, general traffic department, Sears, Roebuck & Co., 925 S. Homan Ave., Dept. 754, Chicago.

Schultz, Harold B. (J) junior designer, Bendix Products Division, Bendix Aviation Corp., 401 Bendix Drive, South Bend, Ind. (mail) 1137 Portage Ave.

Wojtasik, Edmund (M) automotive engineer, Sinclair Refining Co., East Chicago, Ind.

Cleveland Section

Mesenhimer, Orland L. (SM) mechanical engineer, U. S. Navy Department, Bureau of Ships, Office of Inspector of Machinery, U. S. N., General Motors Corp. (CDED), Cleveland.

Shiverick, Asa, Jr., (J) Student, Thompson Products, Inc., 2196 Clarkwood Rd., Cleveland.

Detroit Section

Bradley, M. A. (A) sales engineer, representative, Budd Wheel Co., 12141 Charlevoix Ave., Detroit.

Dantzer, Clarence L. (M) full size layout draftsman leader, Murray Corp. of America, 7700 Russell St., Detroit (mail) 4402 Canton Ave.

Doerr, Raymond S. (J) engineer, draftsman, General Motors Corp., Detroit (mail) Bonita Apts., 69 Seward Ave.

Jones, Robert Ralph (J) assistant to metallurgist, Thompson Products, Inc., Detroit (mail) 1548 Longfellow.

Koppinger, Nicholas G. (M) tool engineer, Briggs Mfg. Co., 2231 Dalzelle, Detroit (mail) 22475 10 Mile Rd., St. Clair Shores, Mich.

Krause, Raymond Stuart (M) full size layout (chassis), Packard Motor Car Co., Detroit (mail) 20739 Wicks Lane, Grosse Pointe Woods, Mich.

Nielson, T. O. (A) sales representative, Budd Wheel Co., 12141 Charlevoix, Detroit (mail) 923 Fisher Rd., Grosse Pointe.

Punke, J. J. (M) development engineer, Precision Castings Co., Inc., 710 Book Tower, Detroit.

Redinger, John, Jr. (J) assistant to metallurgist, Thompson Products, Inc., 7881 Conant, Detroit (mail) 3006 Chalmers.

Smith, Tom Y. (M) chief industrial engineer, Stinson Aircraft Division, Vultee Aircraft, Inc., Wayne, Mich. (mail) 24637 Rockford Ave., Dearborn, Mich.

Strickland, Harold A., Jr. (J) electrical development engineer, Budd Wheel Co., 12141 Charlevoix, Detroit.

Tharp, Wilbur G. (A) draftsman (aircraft engines), Packard Motor Car Co., E. Grand Blvd., Detroit (mail) 1715 Seward, Apt. B-5.

Windeler, Edmund Lee (J) assistant head, experimental data section, Pontiac Motor Division, General Motors Corp., Experimental Dept., Pontiac, Mich.

Indiana Section

McKee, Murray P. (J) experimental engineer, Noblitt-Sparks Industries, Inc., Columbus, Ind. (mail) 1617 Meridian Ave.

McMahon, Harold H. (M) project engineer, Allison Division, General Motors Corp., Indianapolis.

Mull, John W., Jr. (A) owner, 333 N. Pennsylvania St., Indianapolis.

Powell, William S. (J) tool engineer, Merz Engrg. Co., 200 S. Harding St., Indianapolis.

Renno, D. G. (M) engineer, charge of cabs, bodies and chassis sheet metal, International Harvester Co., Inc., Pontiac St. and Bueter Rd., Fort Wayne, Ind. (mail) 1128 Lincoln Highway, East, New Haven, Ind.

Metropolitan Section

DeBard, Edward F. (J) engine operator, Socony-Vacuum Oil Co., Inc., 412 Greenpoint Ave., Brooklyn, N. Y. (mail) 9701 193rd St., Hollis, L. I., N. Y.

Horwath, Albert Stephen (J) power plant engineer, Brewster Aeronautical Corp., Long Island City, N. Y. (mail) 187-24 87th Drive, Jamaica, L. I., N. Y.

Lawrence, Kenneth Van Wart (J) Tide Water Associated Oil Co., 17 Battery Place, New York City (mail) 70 Marble Hill Ave.

Myers, Finley B. (A) supervision company cars, C.I.T. Corporation, 1 Park Ave., New York City (mail) 37-16 65th St., Woodside, L. I., N. Y.

Peenstra, Abram G. (A) instructor, Stewart Technical School, 253-7 W. 64th St., New York City (mail) 273 S. Grove St., Freeport, L. I., N. Y.

Saladino, George P. (A) service manager, Manhattan Pontiac Corp., 239 W. 66th St., New York City (mail) 3705 79th St., Jackson Heights, L. I., N. Y.

Milwaukee Section

Aschauer, George R. (J) experimental engineer, Twin Disc Clutch Co., 1328 Racine St., Racine, Wis.

Lukey, John Bernard (J) machine design engineer, Kearney & Trecker Corp., 68th St. and National Ave., West Allis, Wis. (mail) 2422 W. Medford St., Milwaukee.

Stephen, James (M) chief engineer, Highway Trailer Co., Edgerton, Wis.

Wood, Harry Francis (M) designing layout draftsman, Nash Motors Division, Nash-Kelvinator Corp., Kenosha, Wis.

New England Section

Grantz, Howard E. (J) engineer, General Electric Co., 920 Western Ave., Lynn, Mass. (mail) 62 Nahant St.

Paradiso, Michael Antonio (J) layout design engineer, Vought-Sikorsky Aircraft Division, United Aircraft Corp., Stratford, Conn. (mail) 35 Main St., Milford, Mass.

Woodward, Alan H. (J) service man, Atlas Imperial Diesel Engine Co., New Bedford, Mass. (mail) 184 Washington St.

Northern California Section

Leveskis, Victor G. (J) assistant engineer, U. S. Navy, Mare Island, Calif. (mail) 937 Contra Costa Drive, El Cerrito, Calif.

Wiener, Norton (J) test engineer, Menasco Mfg. Co., Burbank, Calif. (mail) 1510 Oxford St., Berkeley, Calif.

Northwest Section

Ray, James H. (A) owner, Carburetor Service Co., West 1318 First Ave., Spokane, Wash.

Philadelphia Section

Ramsey, Robert P. (M) executive engineer, National Supply Co., Rhawn & Frankford, Philadelphia.

Pittsburgh Section

Lewis, Caryl Clyde (M) factory manager, Bendix-Westinghouse Automotive Air Brake Co., 5001 Centre Ave., Pittsburgh.

Southern California Section

Anderson, Guy B. (M) project engineer, research department, Librascope, Inc., 72 North Tujunga Ave., Burbank, Calif. (mail) Mackenzie Hotel, 339½ N. Brand Blvd., Glendale, Calif.

Bunsen, William F. (J) aeronautical engineer, junior executive, engineering department, Ryan Aeronautical Co., Lindbergh Field, San Diego, Calif. (mail) 322 Upas St.

Hubbard, William Deane (J) learner weight control engineer, Lockheed Aircraft Corp., Burbank, Calif. (mail) 205 B, W. Chevy Chase Drive, Glendale, Calif.

Johnson, Clarence L. (M) chief research engineer, Lockheed Aircraft Corp., Burbank, Calif. (mail) 16801 Oak View Drive, Encino, Calif.

Shannon, Jack (A) Lockheed Aircraft

Corp., Burbank, Calif. (mail) 523½ N. Sycamore, Los Angeles.

Southern New England Section

Abild, **Robert Noble** (J) draftsman, Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn. (mail) 44 Livingston Rd.

Brown, Elmer L. (A) automotive engineer, Socony-Vacuum Oil Co., Inc., 134 Forbes Ave., New Haven, Conn.

Washington Section

Lawrence, **William Camp** (M) Office of Production Management, Room 4030, Social Security Bldg., Washington (mail) 3117 Northampton St., N.W.

Outside of Section Territory

Eichorst, **Herman H.** (A) service manager, Phoenix Motor Co., 401 W. Van Buren St., Phoenix, Ariz. (mail) 1109 W. Willette St.

Haas, Lowell E. (J) instructor, University of Oklahoma, Department of Engineering, Norman, Okla.

Hykes, Paul G., 1st Lt. (J) U. S. Army, 69th C. A., Camp Hulen, Tex.

Lufkin, Hamilton (M) mechanical engineer, State of Minnesota, Department of Highways, 1264 University Ave., St. Paul, Minn.

Sanford, Albert C. (J) sales engineer. Sun Mfg. Co., 6323 Avondale Ave., Chicago (mail) 553 Washington Ave., Albany, N. Y.

Wroblewski, Woodrow L. (J) engineer, Wroble Engrg. Co., 1001 Chrisler Ave., Schenectady, N. Y. (mail) 1067 Davis Terrace.

Foreign

Lord, Leslie Edward (A) assistant works manager, Cooke Howlison & Co., Ltd., Hanover St., Dunedin, New Zealand (mail) 64 English Ave., Mornington, W. 1.

About SAE Members

(Concluded from page 13)

▪ *Sweden-born* GUSTAF CARVELLI *(M '21) acquired his love for aircraft while serving with the Swedish Air Corps, during the exciting post-war days. That was shortly after he had graduated from the Orebro Institute of Technology with an M.E. degree (1913), and shortly before he came to this country and made a name for himself in aircraft-engine development work. Today he is project engineer on engine development, of the Wright Aeronautical Corp., and for the past two years has been actively engaged in standardization work. As ground work for his present position, he was connected with the Curtiss Aeroplane and Motor Co. from 1920 to 1931, in development of liquid-cooled engines (D-12 and Conqueror) and air-cooled engines.*

▪ WALTER F. CRAIG, *after receiving his B.S. degree from Iowa State College in 1936, joined the metallurgical staff at Gary Works of Carnegie-Illinois Steel Corp. He specialized in problems associated with hardenability testing and heat treatment of steel, and is at present metallurgical representative, Chicago district, Carnegie-Illinois Steel Corp.*

▪ *Since 1929* W. H. CURTIS, *father of the Curtis-Curtis engineering team, has been engaged in research, development, and manufacturing activities in pumps and meters for the petroleum industry. Five years of this period were spent with the National Pumps Corp., Dayton, Ohio, where he started as research engineer. Lately associated with Thompson Products, Inc., Cleveland, he continues active research on the more pressing problems encountered in fuel systems of modern aircraft.*

▪ R. R. CURTIS, *son, graduated from the University of Cincinnati in 1935 with the degree of aeronautical engineer, after spending five years at Wright Field, under the cooperative system. Associated, progressively, with the Glenn L. Martin Co., the Romec Pump Co., and the Curtis Pump Co., he today specializes in research and development on aircraft pumps. The Curtis Pump Co., of which Mr. Curtis is now executive vice president, is closely affiliated with Thompson Products, Inc.*

▪ *Upon graduating from Lehigh University in 1922,* OMAR V. GREENE *went to work as metallurgist with the Reading Co. He remained in this capacity*

until 1928, when he took his present position as assistant metallurgist, Carpenter Steel Co., Reading, Pa.

■ **M. A. GROSSMANN** *is director of research at Carnegie-Illinois Steel Corp., a position he has held since 1935. An M.I.T. graduate, Mr. Grossmann stayed at the Institute through 1911-12 as assistant, following up with three years of experience in the Pittsburgh Testing Laboratories. From 1915-17 and again from 1919-20 he was associated with the Vanadium Corp. of America. Then followed work with Atlas Steel Corp., Republic Steel Corp., and finally in 1931 with Carnegie-Illinois Steel Corp. Mr. Grossmann received his D.Sc. from Harvard in 1930.*

■ *For the past three years,* **CARL B. POST** *has been in charge of research and development work with the Carpenter Steel Co., Reading, Pa. From 1932-37 he was assistant metallurgist with the Weirton Steel Co. He received his B.S. from the University of West Virginia in '31, and his Ph.D. from Pennsylvania State College in '38.*

■ *The effect of slight variations in steel on production first intrigued* **RICHARD K. WUERFEL** *back in the days when he was working in the automobile plant of the Dodge Brothers Division, Chrysler Corp. Today, as research metallurgist for Chrysler, he is still ardently engrossed in the exciting search for perfection in steels. Mr. Wuerfel attended the University of Michigan and studied electrical engineering. He is a native Detroiter.*

News of the Society

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around $1,000, is the present plan. The four-wheel landing gear makes level landing easy and practicable, and may lead the way to a unit capable of highway travel after removal of wings. Use of pusher type propeller mount not only adds to propeller efficiency, but gives the pilot better vision.

Mr. Stout's present work is in developing welding and manufacturing technique suitable for stainless steel, using all corrugated sections combined with a modified Wagner truss principle. The new machine, stated Mr. Stout, will reduce flying to a basic simplicity, allowing the student to solo after four hours and cross-country after eighteen hours.

In discussion, Howard Baxter, Winslow Engineering Co., asked Mr. Stout if the British had discovered any new engine developments from German planes shot down. In answering, Mr. Stout said that to date little of significance had been discovered, pointing out that European engines and planes are different from ours in that they must use lower grade fuel and that their flying distances are much shorter than ours. Most of the German engines have solid injection of fuel, stated Mr. Stout. However, that is not a new development, he added. The only air-cooled engines which Germany has are Pratt & Whitney's, built under a licensing arrangement, and somewhat inferior to the same engine built in this country due to present metallurgical conditions. However, German development of air-cooled engines may soon be well worth looking into, he added.

Referring back to the small engined private plane, Alfred G. Cattaneo, Shell Development Co., asked if diesels will be widely used. Mr. Stout said that fuel will be a limiting factor in the wide use of diesels. He stressed the fact that it will be necessary for private planes to adopt the same fuel as automobile engines are using since they would need to use the same service stations.

Questioned by R. Wayne Goodale, Standard Oil Co. of Calif., Mr. Stout reported that the performance of the Lockheed P-38 is good and that what problem there may be is one of operation, due to the use of two engines and double the number of instruments, which makes it difficult for one man to take care of everything.

Describing them as "good for what they're good for," Mr. Stout stated that the newer plastics are superior to those previously available, but that they are not yet in any reasonable position to compete with other forms of construction.

Likely Solder Substitutes Explored by President Colwell

■ ***Milwaukee***

Reviewing likely solder substitutes, SAE President A. T. Colwell, in his "Behind the Scenes in National Defense Engineering" speech, delivered before the Milwaukee Section, May 16, said that a 95% silver solder has good strength. On this same theme, Mr. Colwell revealed that a 97.5% lead 2.5% silver solder can replace the usual 45% tin 55% lead for nearly all uses. Other usable solders are: 82.5% cadmium 17.5% zinc; 95% cadmium 5% silver; 85% lead 15% cadmium plus a little bit of zinc.

President Colwell has been touring the sections, giving intimate pictures of National Defense progress. Specifically, he has dealt with the flow of widespread research and development work of scientists in medical, engineering, metallurgical, chemical and other fields toward the reservoir of National Defense through the coordinating efforts of the Society and other national organizations.

Streamlined Procedure Asked for SAE Aeronautic Standards

SAE aeronautical standards will be published immediately upon approval by the Aeronautics Division of the SAE Standards Committee – without awaiting formal approval by the General Standards Committee – if expected Council assent is given to a recommendation being made by the Aeronautics Division with the approval of General Standards Committee Chairman J. H. Hunt.

Purpose of this streamlined procedure will be to speed up production of defense-needed standards and get them into practical use at the earliest possible moment.

These aeronautic standards will be set under general methods and procedures approved by the General Standards Committee, of course, and will be subject to subsequent final ratification by the General Standards Committee and the Council as are all other SAE Standards.

Council Approves Action on Standards

A joint study of the ASME-SAE Technical Committee on Automotive Rubber, of a survey of the several state requirements in respect to hydraulic brake hose, resulted in a standard approved by the Council during the Summer Meeting.

Work on additional specifications for vacuum and air-brake hose is in progress, the Council was told.

The specification covering the 1/8 in. size, calls for a bursting strength of 3000 lb per sq in. for one minute, followed by a 4000 lb per sq in. for one minute, and no sample shall burst under 5000 lb per sq in.

Proposed American Standards for reamers; another for T-slots, their nuts, bolts, tongues and cutters; and another for jig bushings, were approved. These projects were developed under the ASA Sectional Committee on Small Tools and Machine Tool Elements, of which the Society is a sponsor. The jig bushing standards were extended to cover additional types of machine-tool fixtures and jigs.

The Council also approved the standard for thin flat uncoated metals, a series of decimal thicknesses up to 1/4 in. This standard is designed primarily for general warehouse stocks, but does not preclude the purchase of materials to customers' special specifications.

7 New AB Engineers Speed Aero Standards Results

The Aeronautical Board – joint standardization body of the U. S. Army and Navy – is adding seven aeronautical engineers to its staff to cooperate with the SAE and other standardization groups and to coordinate the work of these groups with the Aeronautical Board.

Three of the new engineers will represent the Navy and four, the Army. They will have headquarters both at Washington and Wright Field, will be available to participate in Standards Committee meetings, and will be active in the strenuous efforts of the Aeronautical Board to convert standards, as presented, into government form as rapidly as possible.

SAE To Publish Drafting Room Manual; Work Started

Preparation of a Drafting Room Manual for aircraft-engine companies was begun by the SAE immediately following approval on June 6 by the Aeronautics Division of the SAE Standards Committee of a motion to proceed with publication of such a manual as soon as possible.

The manual will be based on recommendations prepared by subcommittee E-8, Drafting Room Practices, of the aircraft-engine subdivision of the Aeronautics Division. It is expected that the new manual will appear in 8½ x 11 in. loose-leaf form and that it will represent to a large degree practices already used widely by important aircraft-engine companies. Prior to its issuance, the manual will be submitted to propeller companies for their comment and suggestion.

Correction – 1941 SAE Handbook Carbon Steel Compositions

BY an unusual circumstance, the prefix X for SAE Steel 1020 having manganese content 0.70-1.00, on p. 304 of the 1941 SAE Handbook was blanked out in printing.

The same omission occurred also in the reproduced table of carbon steels at the top of p. 19, June 1941 issue of the SAE Journal.

It is suggested that all members and non-members having copies of the 1941 Handbook, correct this number to read X1020.